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EDITORIAL

Agricultural Marketing. The wholesale prices of most of the important agricultural products are largely determined by world conditions. The surplus production of most of the commodities is exported, and the prices of the exports are determined by competition with other world supplies in the European wholesale markets. Farmer's prices are not based upon any conception of costs of production, but upon forces in which he has no voice. It may be argued by some economists that if prices are unprofitable to the farmer, the situation will correct itself by diminished production, but it is a matter of experience that it takes a long time before this principle becomes operative. The cultivator must plant if he would live, and he must sow long in advance of his knowledge of prices or world production. He cannot make contracts in advance of his planting. Nor can he cease operations on the day prices fall too low. He is driven on, year after year, in hope and necessity and will continue so over long periods with a return below rightful living, because he has no other course. He may change rapidly from the production of one commodity to another, but he must raise *maximum* of something. He cannot organize to put his industry on a "cost plus" basis, as industrial producers do, and a remedy must, therefore, be found elsewhere. Considerable benefit would accrue to the farmers if the gap between the wholesalers' price and the farm price, i. e., the cost of marketing, can be reduced.

The principal object of the marketing surveys, that have been conducted during the course of the last four years, is to find facts which are necessary preliminaries for devising suitable measures to increase the farmers' share of the wholesale price. The constructive work which has just commenced holds out considerable promise. The developmental work is altogether very recent, and within a period of less than a year, produce worth two lakhs of rupees was marketed directly by the various Producers' Associations in the Madras Presidency. Graded Virginia tobacco valued at about a lakh of rupees has been exported from Guntur to England.

Studies of the cost of marketing agricultural produce have shown that the margins between our farmers and wholesalers in commodities are higher as compared with continental countries. This is due partly to the wide distances of the producing areas from the dominating consuming areas, but

there are other contributory forces that can be remedied. It is also admitted that this margin has increased considerably after the Great War. It would be helpful if we can ascertain the proportion that each of the farmers, middlemen, storage, railways, manufacturers, wholesalers and retailers receive. The object of the enquiry is to determine the charges that can be legitimately minimized.

Transport, storage, handling and manufacture are conducted upon a basis of cost plus either fixed returns, or, as is more usually the case, a percentage of profits upon the whole cost of operation. Any marketing agency ceases to operate when it does not secure costs and profit—with the result that all the links in the distribution put up resistance to the curtailment of the margin. If rapid falls in prices occur, the farmer at least in the first instance, has to stand most of the fall because he cannot quit; and the farmer's cost of production relates to a period long prior to the fall. The farmer has only one turn-over in the year, but the middleman has several and can thus adjust himself quickly. The custom of many of these businesses is to operate upon a percentage of profit on the value of commodities handled. When the prices rise, their profits increase and the farmer does not derive the full benefit.

In order to sell his produce, the farmer often makes a sacrifice in price during the local glut period. The consumer on the other hand in certain centres is compelled to pay an increased price due to the shortage in the market.

This requires adjustments between demand markets and supply centres. This is sometimes due to the shortage of railway wagons. Warehouses and elevators would facilitate proper storage of the produce and would provide better average load for the railways easing seasonal pressure on traffic. Certain commodities are stored in the open and during the rainy season the produce becomes wet and the quality lowered as is the case of the groundnut. Ultimately it is the farmer that pays for improper storage. Warehouses, elevators, refrigerator-cars etc., should not be the monopolies of private concerns; they are public utilities.

In India unfortunately the export business of many agricultural commodities is in the hands of a few concerns. When a few concerns have the responsibility of buying and storing the seasonal reserves of a single commodity, they naturally reduce prices during the heavy production season, and increase them in the short season, as a method of diminishing their risks and increasing profits. They do not need to conspire, for there can be perfectly coincident action to meet the same economic currents. Such coincidence, however, has much greater possibilities of general influence with a few concerns in the field, than if there were many. When a concern or concerns obtain such dimensions that they can influence prices or dominate public affairs, either with deliberation or innocence, then it must be placed under regulation and restraint, for when they are able to dominate the

community it becomes a social necessity that they shall be made responsible to the community. The test that should apply is the proportion of the commodity that a concern controls in its operations.

The farmer out of necessity must market his produce at certain seasonal periods. Perishables must be marketed fairly promptly as he cannot himself maintain necessary special types of storage. Consequently the dealer must speculate on carrying commodities for distribution during the periods of short production, while the farmer markets in time of surplus production. The charges for this hazard are debited to the farmer. The central exchanges might reduce this hazard. The farmer then can be protected against local manipulation of prices, and forward contracts can be made between the farmer and the consumer on standardized commodities. Such contracts remove the necessity of a speculative middleman. The grower would be assured of the price. The contracts and the direction for shipment would flow naturally to the distributor where the product is really needed.

Co-operative marketing is no doubt the best immediate solution for the farmer, but co-operative marketing to be attractive must be coupled with the credit work. The middlemen advance loans before the crop is sown and unless the co-operative societies can furnish all the facilities that the middlemen give, the progress of co-operative marketing cannot be rapid. In Baroda we understand that the State has recently commenced the issuing of crop loans for sowing improved types of cotton at 4·5 per cent. interest. It is obligatory for the farmer who receives the loan to market his produce through the agency of the co-operative marketing society. The scheme is welcomed with much enthusiasm; and it is stated to be working quite successfully.

STUDIES IN SUGARCANE

IV. Variations in the Concentration of Juice in Sugarcane.

BY

P. V. RAMIAH, M.A., B.Sc. (Edin) and T. VARAHALU, B.A., M.Sc.,

Agricultural Research Institute, Coimbatore.

In the course of studies on the biochemistry of sugarcane with particular reference to its maturity and arrowing, the authors felt a need for an exact knowledge of the actual mode of distribution and accumulation of sugar in sugarcane at several stages of its growth and development, in order to be able to satisfactorily explain some of their data.

Information in the literature that is available was found to be inadequate to meet their needs. Therefore it was proposed to follow the distribution of the concentration of juice over the entire length of the cane, from the growing point down to its bottom, flush with the surface of the soil.

The results obtained indicated that the concentration in the juice varied not only from top to bottom, but also within each internode and that the variations were very regular, and obviously with a bearing on the physiology of the sugarcane; for this reason, they are presented in this paper, as they might also interest other workers.

Experimental. For the purpose of the present investigation the entire cane was carefully stripped of all its leaves, so that even the most tender internodes at the top, including the growing point, remained intact. The internodes were numbered as follows—the growing point and the closely packed rings of internodes just below it were all numbered together as 1, and the one below it 2, and so on upto "n" towards the bottom of the cane. In the case of the arrowed canes and those in shot blade, the top most internode, distinguishable as such, below the inflorescene or flower primordia, was numbered 1, and the numbering thereafter was the same as in the unarrowed cane.

By means of a sharp cork borer (0·5 cm. dia.) the cane was bored at very short intervals leaving a minimum space between successive borings (vide inset of internode and node in the charts). In this experiment three distinct regions were distinguished in the nodal part of the cane. They are (1) the intercalary meristerm (growth ring), (2) the keim ring (bud and root primordia) and (3) zone of insertion of leaf sheath (leaf scar) (1). Wherever it was possible the cane was bored separately through these regions of the node. In the case of variety Co. 213 (chart 1) the keim ring and the leaf sheath insertion zones were taken together for puncturing. The juice from the core bored out was pressed out and its refractometric brix was read off with Zeiss Hand Refractometer. All the necessary precautions were taken to prevent or minimise errors due to probable rapid evaporation from small quantities of liquids expressed. For this purpose preliminary check

determinations were made with respect to the factors of time and the changing air temperatures.

The results are represented graphically (charts I, II & III). An examination of the data and of the curves goes to indicate, in general, the following. Detailed data have not been included for purposes of brevity of the paper. The graphs in charts show general trends.

1. In the young cane, or in the younger parts of any cane, the concentration of the sap at every point within an internode, is lower than the concentrations in the two nodes at its either end. Between the concentrations in the two terminal nodes of any internode, that in the top node is always of lower magnitude. Their concentration curves are therefore troughs lying below the levels of the concentrations in their two terminal nodes. (Graph 3, internodes 3—7, graph 4, internodes 1—5).

2. The concentration curves of internodes indicate two minima, one at its either end. At the centre or in the upper half of the internode a higher value is located. Of the two minima, the one nearer the bottom node is lower, and corresponds to the intercalary meristerm situated at the base of the internode, and the other minimum of higher magnitude, corresponds to region at and just below the leaf sheath insertion zone. The curves therefore roughly resemble the letter W—with un-equal limbs. (Graph I).

3. It is noticeable (young canes Co. 223 : graphs 3—5 and Co. 243 : graphs 6—8) that the concentration of juice in any internode commences to increase earlier at its top.

4. As the cane advances in age, the concentrations in both the nodes and the internodes tend to increase The concentrations in all the nodes in a cane rapidly tend to approach a common value, such that the line passing through the points representing their concentrations tends to run parallel to the horizontal axis (graph 2).

5. As the internodes develop, the concentrations within these increase more rapidly. In time, the concentration at every point in the internode moves far above the levels of those at the nodes, such that the curves gradually cease to be troughs and finally assume bell shapes, with every point on the curve situated above the level of the nodal concentrations. In each case a maximum value is located at about the centre of the internode (chart I : graph 2). In this graph, the curves for the three internodes at the top alone are troughs and those for the rest are all inverted and bell shaped.

The various stages of the course of this transformation in shape, from troughs to bell shaped ones, are noticeable in all cases (charts I, II & III).

Taking the cane as a whole, these changes in the shapes of the curves begin to occur earlier and faster in the internodes at its bottom. But within any given internode, irrespective of its location in the cane, similar changes occur, but in the opposite direction, from top downwards.

6. In canes which are more advanced in age (Co. 213 : Chart I), the maximum concentration for the juice in the cane, seems to be located in its

central internodes and in the central portions of individual internodes. Previous workers also viz., Went (2), Venkatraman and Rao (3), Viswanath (4), Quintus (5), and Kerr (6) have noticed that as cane matures the maximum tends to travel towards the centre of the cane.

7. The general trend of the movements of the concentration of the sap is similar in all the varieties irrespective of (a) their ages, (b) the time, in the day, of cutting the canes, and (c) whether the cane is arrowed or unarrowed, or is only in shot blade.

8. Comparing graphs (1) and (2), it will be seen that the differences in the shapes of the curves pertaining to individual internodes in the two canes are very striking. In the light of the foregoing, it is obvious that the internodes in the one cane (graph 1) are physiologically very young and are far behind those of the second cane (graph 2). The two canes are of equal ages, having been planted and harvested at the same time under pot culture conditions. In the one case, the cane was manured with castor cake, while the second received no manure.

The differences in the physiological development of canes of equal ages are evidently due to differences in the nutritional conditions under which they are grown. Canes which do not get enough nutrition would seem to tend to finish their life cycle much earlier.

9. The figures in Statement (1) representing the maximum and minimum concentrations within individual internodes clearly point that the concentrations even in the same internode are not uniform and that the differences are very wide.

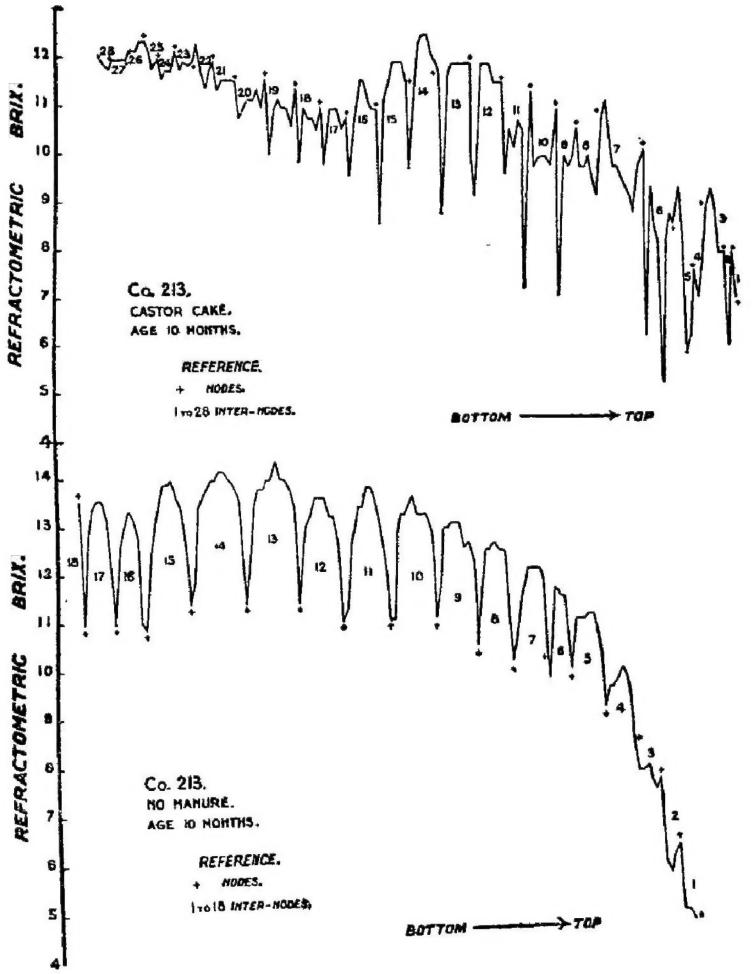
Discussion. In the sugarcane, as in all monocotyledons, the internodes elongate acropetally from bottom upwards, consequent on the activity of the intercalary meristem situated at the base of the internode. Thus the top portions of any internode are the earliest to be formed, and as such, they constitute its older parts, and those at its bottom, the youngest. Traversing from the bottom to the top, the younger internodes are met as we progress upwards. On the other hand, taking each individual internode in the same cane, one meets with progressively older parts laid down in the same direction.

It was indicated by one of us (Varahalu, 7) that at least a certain minimum growth and development of tissues is an essential condition precedent for the commencement of the storage of sugar in sugarcane. In sugarcane therefore this minimum development must be expected to be attained earlier in its bottom internodes, and in the top portions of its individual internodes. Therefore sucrose accumulation should also be expected to commence earlier in these parts. The experimental evidence presented in the paper is in complete accord with what may be expected.

2. The data presented indicated that there are two minima in concentration curves for every internode, and these are situated, one at its either end. This is as may be expected.

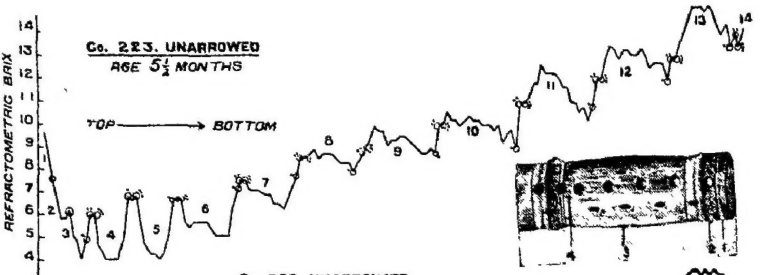
Variations in the Concentration of Juice within Sugarcane.

Graph (1).

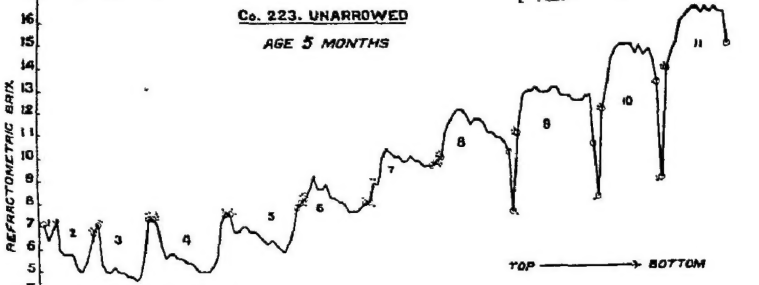


Graph (2).

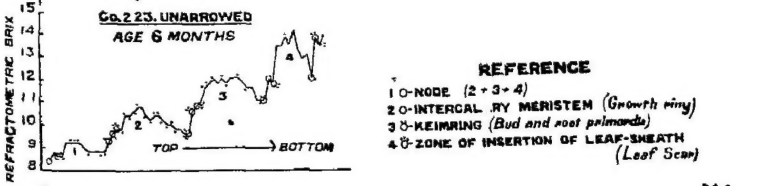
Variations in the Concentration of Juice within Sugarcane.



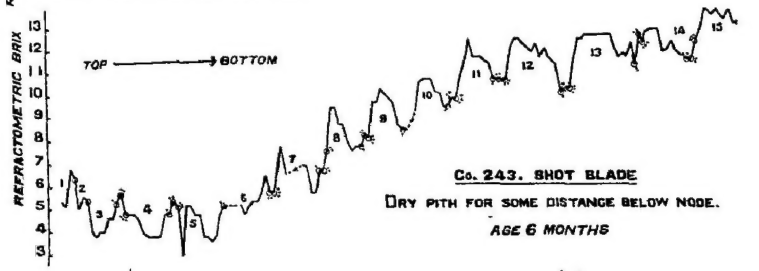
Graph (3).



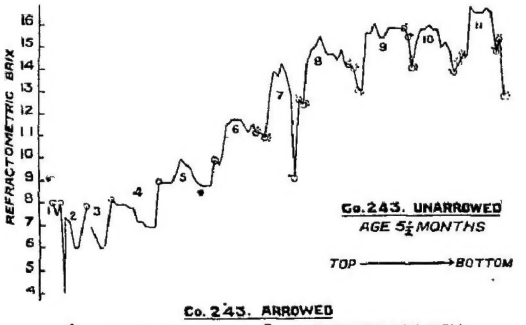
Graph (4).



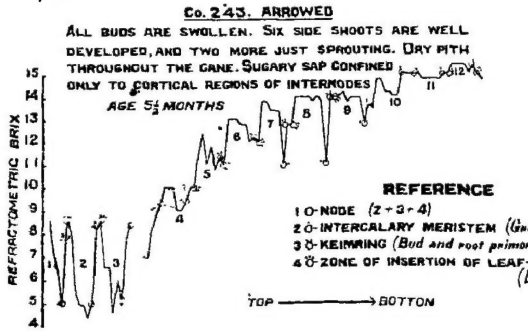
Graph (5).



Graph (6).



Graph (7).



Graph (8).

It is well known that when supplies of sugar and other labile food material increase within a plant or in any part thereof, quicker differentiation of tissues and rapid thickening of the walls is stimulated, with the ultimate result that the tissues tend to lose their plasticity and become merely mechanical units of the plant.

In the regions of the leaf sheath insertion, labile food materials synthesized in the leaves, find entrance into the cane continuously in larger quantities. As such it should be expected that both the water content and the concentration of the juice extractable from this region and from regions just subjacent to it, should gradually tend to fall to a minimum. This is what was observed.

Again, as the meristematic tissue at the base of the internode is constantly utilising large quantities of water and food to meet its high energy requirements for the production of newer cells, there can naturally be expected only a balance of minimum of concentration of sugars at this end of the internode, and this is so. This latter minimum is also the lower of the two minima.

3. As the lower portions of the internode above the intercalary meristem are, at any instant, comparatively younger than those in the top portions of the same internode, the speed of increase in the concentration of the juice in these portions should also be expected to be slow. The experimental data actually indicated this. The portions of the curves pertaining to this region are the last to cross and go above the level of the nodal concentration.

4. Further as the top portions of the internode are older and tend to get continually more woody earlier, and those towards the bottom are young, and as these relative positions hold, at any instant, in all internodes, it can easily be realised that the maximum concentration in the sap within any internode should occur at about its centre or just above it. The data, presented, as was already seen, bear out this.

5. The observation that "as cane matures the maximum for the concentration of its juice tends to travel towards the centre of the cane," can also be explained on just similar considerations.

Taking the cane as a whole, which is mature or is approaching maturity, it contains towards its bottom, internodes which are older and more woody and so with lower concentration of juice. Again, towards its top it contains internodes which are young and still growing and for this reason they also contain lower concentrations. Thus the picture here is just similar to what obtains in any one of the individual internodes, but with this difference, that the location and the direction of the young and the older portions are reversed in this case.

Therefore as in any internode, so in any mature cane, it should be expected that the maximum concentration of juice should seem to be located in its central internodes, which are neither too young, nor too old.

While this seems to be the most plausible explanation, a yet another possibility contributing to this end also seems to operate. As will be shown in a subsequent communication, the curves for the development of the leaves, their dry matter as well as their functioning surface areas, indicate maxima in the regions of those leaves which are attached to the nodes situated in the second and the third quarters of any cane. It may therefore be expected that due to this cause also comparatively greater quantities of sugars might be enabled to be stored within the internodes to which the leaves pertain.

In any case the apparent travelling of the maximum towards the centre of the cane seems to mark only a stage in the normal physiological development of the cane.

6. Considerations in the paper should also lead to another possibility. When the whole cane becomes fully mature and tends toward over-ripening, the bell shaped curves in all internodes should gradually tend to flatten out until the new curves become parallel to the horizontal axis, as each internode loses its plasticity and becomes more woody. This is being verified by further work.

Summary. 1. The distribution of concentration in the sap of sugarcane over its entire length from its growing point down to its bottom was followed with the aid of hand refractometer. The canes selected were of ages 5, $5\frac{1}{2}$, 6 and 10 months. They include canes which are (1) unarrowed, (ii) arrowed, (iii) which are in shot blade and (iv) those which are treated with and without manure. They also included canes which were cut at different parts of the day and night. For purposes of this study three distinct regions were distinguised at the nodal parts. They are (i) intercalary meristem (growth ring), (ii) Keim ring (bud and root primordia), and (iii) leaf sheath insertion zone (leaf scar).

2. The distribution and the mode of accumulation of sugar in juice during the development of cane towards its maturity follows a regular sequence which is interesting from the point of view of the physiology of sugarcane.

3. The forms of concentration curves and the character of the several changes in form which they undergo are similar in all cases, irrespective of the time of cutting the cane, and whether it is arrowed or unarrowed, manured or unmanured, or whether it is only in shot blade.

4. The concentration of juice is not strictly uniform, either in the whole cane or in any of its internodes. But as the cane matures, or advances in age, the differences in the average concentration of juice in successive internodes tend to get considerably narrowed down.

5. In the internodes, beyond certain stages in their development, there occurs maximum concentration about their central parts, and two minima, one at either end of each internode. One of the two minima corresponds to the intercalary meristematic zone at the base of the internode and

the other to the zone of leaf sheath insertion at its top. The former is the lower of the two minima.

6. In a young cane and in the younger parts of a developed cane, the concentrations at all points within an internode are lower than those in the keim ring and the leaf sheath insertion zones. The concentration curves are troughs lying below the levels of the nodal concentrations.

7. But with advance in age, the concentration in both the nodes and the internodes, gradually increases, those in the nodes, all tend to become equal and attain a stationary level. Within any internode the concentrations at all points in it gradually increase beyond those in the nodes, and continue to do so, such that in time, the forms of their curves get completely inverted. They change their shapes from troughs, lying entirely below the level of the nodal concentrations, to bell shaped ones, with every point on them being far above the concentrations in the nodes. The rate of this change however varies from point to point in the internode. The change is very gradual and commences earlier from the top of the internode. All the possible intermediate transitional stages through which the curves pass in the process leading to their complete and the final inversion are illustrated.

8. Taking the cane as a whole the concentration in it commences to increase earlier at its bottom, but taking each internode in it individually, the increase occurs earlier at its top. With advance in age, the concentration in both gets to be maximum in their central parts.

9. Manuring seems to keep the cane physiologically much younger than the one which is of equal age, but which received no manure.

The authors take this opportunity to offer their thanks to Rao Bahadur T. S. Venkatraman, C. I. E., the Government Sugarcane Expert, for the help he so readily rendered in keeping at their disposal all the necessary cane material for their study, and to Mr. C. R. Srinivasan, the Paddy Specialist for the facilities he afforded for carrying out the work in his field laboratory at Vedapatty. Our thanks are also due to Mr. R. Thomas, Assistant Sugarcane Expert, for his willing co-operation during the progress of the work.

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STATEMENT 1. Maximum and Minimum concentrations (Brix) in successive Internodes of canes.

CO. 223. Unarrowed cut at 12-30 A. M. midnight. Brix.			CO. 223. Unarrowed cut at 3 P. M. Brix.			CO. 243. Unarrowed cut at 2-30 P. M. Brix.			Co. 213. Unarrowed. No Manure cut at 10 A. M. Brix			Co. 213. Unarrowed manured with castor cake, cut at 10 A. M. Brix.		
Max.	Min.	Diff.	Max.	Min.	Diff.	Max.	Min.	Diff.	Max.	Min.	Diff.	Max.	Min.	Diff.
5·8	5·8	0·00	6·8	6·4	0·4	7·4	7·4	0·0	5·8	5·4	0·4	8·4	7·0	1·4
5·0	4·0	1·00	6·0	5·0	1·0	8·0	6·0	2·0	7·8	7·2	0·6	6·8	6·0	0·8
4·8	4·0	0·80	5·8	4·6	1·2	7·2	6·0	1·2	9·8	8·2	1·6	8·4	4·8	3·6
5·6	4·0	1·60	7·2	5·0	2·2	7·8	7·0	0·8	11·0	10·0	1·0	8·4	4·2	4·2
6·2	5·0	1·20	7·0	5·8	1·2	10·0	8·8	1·2	11·6	9·6	2·0	10·2	7·8	2·4
7·4	6·2	1·20	9·2	7·6	1·6	11·8	10·2	1·6	12·0	10·6	1·4	9·0	8·2	0·8
8·8	7·7	1·00	10·4	9·6	0·8	14·2	13·0	1·2	12·6	11·0	1·6			
9·8	8·8	1·20	12·0	10·6	2·6	15·6	14·4	1·2	13·0	11·6	1·4	9·0	6·0	3·0
10·4	9·0	1·40	13·0	12·4	0·6	16·0	13·2	2·8	13·6	11·0	2·6	9·0	8·8	0·2
12·0	10·0	2·40	14·8	13·0	1·8	16·2	15·2	1·0	13·8	11·2	2·6	9·6	6·2	3·4
13·2	12·4	0·80	16·2	14·0	1·6	17·4	14·8	2·2	13·6	12·6	2·0	11·0	7·8	3·2
14·8	13·4	1·40							14·4	12·6	1·8	11·6	8·8	2·8
									14·2	11·8	2·4	11·0	7·6	3·4
									14·0	11·4	2·6	10·6	8·6	2·0
									13·6	11·0	2·6	10·0	8·8	1·2
												10·0	8·8	1·2
												10·2	9·0	1·2
												10·4	10·0	0·4
												10·6	10·4	0·2
												11·2	10·4	0·8
												11·0	10·8	0·2
												10·8	10·6	0·2
												11·2	11·8	0·4
												11·4	11·2	0·2
												11·0	11·0	0·2
												11·0	10·8	0·2

A NEW FACTOR DETERMINING THE TINT OF RED AND YELLOW GRAIN COLOURS IN SORGHUM

BY

G. N. RANGASWAMI AYYANGAR, F. N. I., I. A. S.,

Millets Specialist & Geneticist, Agricultural Research Institute

and

A. KUNHIKORAN NAMBIAR, B. Sc. Ag.,

Assistant, Millets Breeding Station, Coimbatore.

In a previous publication (Rangaswami Ayyangar, *et al*, 1933) the interrelationships between red, yellow and white grain colours in sorghum have been pursued. Yellow (factor Y) is the basic colour. With R, red grains are produced. A factor W determines the manifestation of colour in wholeness on the pericarp. Without W, R gives a white grain with a red base. Similarly Y gives a white grain with an yellow base, the red and yellow bases being within the protection of the covering glume. Dry anther colours run parallel to grain colours and help in the separation of the white grains into their respective allelomorphs to coloured grains. A factor—I—determines the intensity of colour manifestation and is unmistakably noticeable in good red grains. W being present, R, without the—I—factor, gives a pink grain.

It was noted that the yellow grains with and without the—I—factor are difficult of separation. The lightness of the colour and the quick reaction to weather conditions coupled with a brown wash found in most of the yellow varieties added to this difficulty. Even so, with the help of the R factor the yellow allelomorphs could be separated. It was thus clear that there were two shades of yellow colour, the typical yellow with the—I—factor and the light yellow without this intensification factor.

Since 1933 a number of varieties of sorghum have come under examination at the Millets Breeding Station, Coimbatore, and this article presents the occurrence and inheritance of certain types of sorghum characterised by a *wash* of colour on their pericarp. The occasion for noticing this character was provided by the existence of a type of irrigated sorghum called the *Makkattai* or *Manjakkattai cholam* (*Sorghum subglabrescens* Schweinf. et. Aschers. var. *rubidum* (Burkill, Snowden) from the Madura tract of the Madras presidency. This sorghum could neither be called red, nor yellow, nor easily white. The Tamil name definitely groups it with the yellow. This variety has its grain base red or yellow, according as the *wash* is red or yellow. When there is a red wash, as in the case of a red base, the dry anther colour shows the existence of this red. It is therefore obvious that this red wash is an aspect of the sap colour red of the red-yellow-white colour series; similarly the yellow wash. To determine the nature of this

peculiar tint of pericarp colour a number of crosses were made between this *Makkattai cholam* and other sorghums, both yellow and white, of known genetic constitutions. *Makkattai cholam* has this advantage in its favour namely that it lacks the B factors and therefore has a pericarp free from the complications of a brown wash. The finer shades of red and yellow could therefore be pursued with a fair amount of ease. Moreover, the pearly nature of the grain affords a convenient background for reading the shades of colour.

The first cross was between *Makkattai cholam* (white grain with a red grain base and a red *wash* on the pericarp), and A. S. 2095 (white grain with a red grain base and without *wash* on the pericarp YYRRww). The F_1 had a white grain with a red grain base and a red wash on the pericarp. In the F_2 there was a simple monogenic segregation for red wash on the pericarp, the segregation being 90 with red wash and 28 without red wash on the pericarp.

The second cross was between this *Makkattai cholam* and A. S. 3681 (white grain with an yellow grain base and without wash on the pericarp— YYrrww.) The F_1 was white grained with a red grain and a red wash on the pericarp. The F_2 segregations are presented below :—

TABLE I

Red grain base, Red wash on the pericarp } X { **Yellow grain base, Without wash on the pericarp**

Family No.	*Segregations.* White grain. Red grain base		Yellow grain base	
	With Red wash.	Without Red wash.	With Yellow wash.	Without Yellow wash.
A. S. 5261	100	36	29	12
„ 5262	111	35	26	11
Total	211	71	55	23
Calculated 9:3:3:1	202·5	67·5	67·5	22·5
	$x^2 = 2·85$	P > 0·05		

From the above segregations it will be noticed that the *wash* factor could be super-imposed on a red or yellow grain base colour, it behaving independently of these grain base colours.

The third cross was between the same *Makkattai cholam* and A. S. 837, which has a pink grain without a red wash on the pericarp (YYRRWWii). In the first generation the grain was pink with a red wash on the pericarp and therefore of a tint deeper than the pink parent. An F_2 generation of five families was raised and the segregations are presented below :—

TABLE II

White grain, Red grain base, Red wash on the pericarp } X { Pink grain, Red grain base, Without red wash on the pericarp

Family No.	*Segregations.* Pink Grain With Red wash.	Pink Grain Without Red wash.	White Grain With Red wash.	White Grain Without Red wash.
A. S. 5254	72	24	24	9
,, 5255	107	37	29	10
,, 5256	98	26	40	12
,, 5257	61	23	21	8
,, 5258	64	20	24	9
Total	402	130	138	48
Calculated 9:3:3:1	403·875	134·625	134·625	44·875
	$x^2 = 0{\cdot}55$	P>0·05		

It will be seen that the two characters red *wash* and pink colour on the pericarp behave independently of each other giving a clear dihybrid ratio.

The fourth cross was also between the same *Makkattai cholam* and A. S. 817 (yellow grain allelomorphic to pink YYWWrrii.) The F_1 plants had a very light red grain. An F_2 generation was raised and the segregations are presented below :—

TABLE III

White grain, Red grain base, Red wash on the pericarp } X { Yellow grain, Yellow grain base, Without wash on the pericarp

Family No.	*Segregations.* Light Red With Red wash	Light Red Without Red wash	Light Yellow With Yellow wash	Light Yellow Without Yellow wash	White With wash	White Without wash
A. S. 5263	65	28	26	8	24	8
,, 5264	45	17	14	5	21	5
,, 5265	58	19	20	8	30	10
Total	168	64	60	21	75	23
Calculated (27:9:9:3:12:4)	173·46	57·78	57·78	19·26	77·04	25·68
	$x^2 = 1{\cdot}42$	P>·05				

From the above segregations on a three factor basis it will be seen that this *wash* factor operates on light red, light yellow and white backgrounds.

Sorghum being a naked grain and exposed to all vicissitudes of the weather, this delicate *wash* factor designated M (after the sorghum variety *Makkattai cholam*) is best pursued in a hot weather crop and in varieties having a sienna coloured dry anther (without brown wash).

Summary. From crosses between the red colour washed *Makkattai cholam* (Sorghum subglabrescens Schweinf. et. Aschers. var. *rubidum* (Burkill) Snowden) and other grain sorghums with the colours of the red,

yellow and white sap colour series, it is seen that there is a definite *wash* character associated with the red and yellow sap colour series of pericarp manifestations. This *wash* factor could be superimposed on the other colours. When the basic colours are deep, the *wash* factor will naturally not show off. When the basic colour is devoid of the--I—factor for intensification and the grains are in consequence pink or light yellow in colour, the superimposition of the *wash* factor, tones up these basic colours by a shade. The best manifestation of the *wash* factor is in the absence of the—W—factor disabling the expression of the other pericarp colours in wholeness and making the grain white in consequence, with the colours red or yellow confined to the base of the grain. On this white background the red wash and yellow wash show off to advantage.

A new factor designated M gives a red or yellow *wash* to the pericarp of the sorghum grain according as the base is red or yellow. The factor operates in the presence of Y or R factor. In the presence of the factor W, its expression is too faint to show out. It shows best in the absence of the W factor. In conjunction with the factor—I—(intensification of pericarp colour), this *wash* factor cannot be easily noted. In the absence of the—I—factor, the *wash* factor M slightly tones up the basic light colour.

Reference.

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SUGARCANE SMUT

BY C. B. FRANCIS,

Cane Superintendent,

East India Distilleries & Sugar Factories, Ltd., Nellikuppam.

I. General. Smut (*Ustilago scitaminea* Syd.) is a well-known disease of sugarcane having been reported from India, Java, Formosa, the Philippines, Natal, Mauritius, Queensland, Italy, and British Guiana (1).

It is principally a disease of the wild cane *Saccharum spontaneum* (1) and those canes which most nearly approach the wild varieties are more susceptible than the noble canes, though the thicker tropical canes are by no means immune (2). The causal organism is also reported to occur on grasses which may be a source of infection (2) It is reported (1) as very severe on Uba and other varieties of the *Saccharum sinense* group. Some varieties are considered to be immune, Earle mentions Badilia* as being one of these, but in the S. Arcot District in South India Badila has recently proved to be susceptible.

II. Symptoms. Sundararaman (3) describes the symptoms as follows:

"The disease is easily recognised in the field. Affected plants are distinguished by the formation of a long, whip-like dusty black shoot from

* Locally known as 'Fiji B'.

the growing shoot. The leaves do not open out but become converted into a long whip-like structure consisting of masses of black spores covered over by a white, papery covering. After a time the white covering ruptures exposing the spores inside. The spores are blown about by the wind and healthy plants are affected. The fungus grows within the plant for a period, and then affects the shoots when in place of the growing shoot the long whip-like structure is formed."

In some cases the side buds of mature canes are infected, in which case the bud "shoots", and when the shoot is about six inches or more long the top shows the typical black spore formation. Sometimes growth is stimulated by the disease so that slender new shoots from the ground or near ground level grow very rapidly upwards and spore formation occurs on a level with the top of the crop where opportunities for dispersal and infection of other plants are the greatest.

III. Control. There is no cure for the smutted plant, and an infected plant can never recover. The only way in which the disease can be stamped out is by removing all sources of infection.

The most successful way of combating any disease is no doubt the planting of an immune variety, but this is often a counsel of perfection. It may happen that the variety affected is one which on account of its suitability from other points of view is considered the best for a particular area, and the discarding of a variety which has hitherto proved to be very useful is likely to be deferred until a serious attempt has been made to control the disease by other less drastic measures. Further, the discovery of an immune and at the same time otherwise suitable variety may take considerable time, and in the meantime some sort of control measures have to be applied immediately. Nevertheless, it is worth while sacrificing an otherwise satisfactory variety if the particular circumstances permit, and if by so doing the main source of infection can be eliminated.

Where an infected variety cannot be completely given up the next best thing is the removal of infected plants.

A wind-borne disease such as smut is very difficult to control as infection can take place without direct contact and at a considerable distance from the source of infection. It is essential therefore that the removal of diseased plants should be done before the spores have had much time to disseminate. Obviously the best time to do this is before the spore formation occurs and in South India it has been found that boys can be trained to recognise a diseased shoot only by its abnormally slender, whiplike nature even before the sooty growth develops. Of course it is not possible for all such shoots to be recognised but the boys can frequently detect them while engaged in removing the more obviously diseased ones. The diagnosis can be confirmed by splitting open the suspicious shoot when in the case of infected shoots the black centre is clearly visible.

There would appear to be three stages during the growth of the cane when this roguing is likely to be most necessary.

(a) *Soon after germination.* At this stage shoots from only some and not all of the buds on a sett may develop the disease. This is probably due to the disease spores having been blown on to the buds of the mature parent canes, the spores remaining on the outside of the bud and infecting the shoot during germination, or by the disease lying dormant in the bud until germination occurs. Some of the buds on the sett may have escaped infection in which case the shoots will be disease-free, while in others the bud or shoot may have been infected, and these shoots will be killed and show the black spore formation.

In this case the whole sett must be removed from the field. If merely cut off some little distance from the sett, tillering will be encouraged and all the tillers will later show the disease.

The fungus enters the cane through the hairs on the buds, more easily through younger buds than older ones. After entry, it spreads throughout the stem but the symptoms become externally visible only at the tip of the shoot. The diseased plants should be rigorously rejected for purposes of propagation.

The soaking of the setts in Bordeaux mixture should go a long way in preventing infection, as although internal infection cannot be treated in this manner any spores on the outside of the bud can be killed by sett disinfection.

(b) *After tillering.* At this time cases may be found in the field in which the infection is due either to bud infection as mentioned above or to shoots being newly infected after germination. The new infection may be caused by spores being carried from diseased bud shoots, or from older cane in the vicinity. Since the harvesting of one crop and the planting of the next overlap, the disease is easily carried over from crop to crop. The only really safe control is the removal of the whole clump as is done for certain bud infection.

(c) *After cane formation.* At this stage buds on apparently healthy canes may show the disease by 'shooting' and then developing the characteristic sorus formation. This is probably caused by the disease spores being carried on to the outside of the cane and infecting the buds as mentioned in (a). In this case it will not be sufficient to break off the shoot close to the cane as not only the bud and shoot will have been infected, but also the older cane. Such clumps should not be used for propagation. The removal of the infected shoot will however minimise the sources of secondary infection.

In the case of (a) and (b) the current crop will be damaged by the death of shoots that would later form canes. In (c) the current crop will not be harmed but the disease will be carried over to infect the next crop.

The above three types of infection will overlap and in order to be effective the roguing must be done continuously throughout the season as the infection may lie dormant for some time before developing. It is essential

that the roughing should be done very frequently as the longer a single diseased shoot is allowed to disseminate the disease spores, the greater will be the extent of new infection.

To reduce the opportunities for the disease to spread among different varieties it is desirable to plant different varieties in separate blocks.

Removal of diseased material from the field and its destruction. As mentioned earlier a smutted shoot can never recover and no treatment is of any avail. The only way of dealing with this disease is to prevent the infection spreading, which can only be done by the destruction of the affected shoot. Destruction inside the field is not practicable and the removal of diseased shoots in which spore formation has occurred is likely, in view of the nature of the disease to result in further spreading unless great care is taken. Careless handling may shake the spores into the wind to be carried to other plants, and contact between diseased shoots and healthy plants can very easily occur during removal of infected plants.

In the Philippines Smut was reported (4) in 1934 to have developed to serious proportions in certain districts and the only promising control so far discovered was the cutting out of the shooty growth that developes from the top of the shoot. To prevent the spores from flying about and spreading the infection it was recommended to carry a five gallon tin of kerosine oil into the field, wet the black tip with kerosine, cut off the end of the stalk and immerse it upside down in the tin. In this manner the infected material could safely be carried out of the field and destroyed.

This is no doubt a safe method of removal, but a tin of oil is a rather awkward thing to carry through a cane field. On the suggestion of Mr. S. Sundararaman, the Government Mycologist, a method has been adopted by the E. I. D. & S. F. in South India which has been found to be safe, simple, inexpensive and effective and which is considered an improvement on the Philippine method.

In this method coolies are sent through the cane, row by row, to search for diseased plants and they are provided with cloth bags, the mouth of which can be closed with a string. The infected shoot is cut off below the black top and is carefully placed in the bag. The remainder of the infected material can then be dug up or removed as necessary, and can be placed in the bag or otherwise carried out of the field, there being no risk of this part without exposed spores spreading infection. The bag containing the infected shoots is kept closed when moving through the field, and when full is carried out of the field, and unopened, complete with the contents, is placed into a drum of boiling water and is kept there for at least fifteen minutes. After boiling, the shoots are dried in the sun and at the end of each day are burned.

Cane trash is usually available for fuel and the only expenses are for labour (boys can do the work quite well), cloth bags, and an old metal drum or other vessel for boiling the water. The bags in use are frequently and

completely sterilised by the boiling so that no infection can be carried by them, and provided they are made of closely woven material and are only opened when necessary, risk of infection during the removal is very small. Placing the unopened bags into the boiling water prevents the spores from being disseminated during destruction, and the boiling completely destroys all infection in the plant. With few clothes to become infected and with frequent opportunities for bathing there is not much risk of the coolies carrying infection on their body.

IV. Results and Cost of Control Measures. A few cases of Smut were found on the estates of the E. I. D. & S. F. Ltd., at Nellikuppam in 1921 the variety worst affected being B. 3412. The planting of this variety was immediately given up. The following season a few canes were found in Badila but these were rogued out and for a few years no trace of the disease was observed.

In 1924—25 Co. 213 was introduced and from the first this variety was found to be susceptible to 'smut.' Cases were continuously being found, but the disease was kept under control by roguing and no infection of other varieties was suspected. In 1932—33, there was a marked increase in the extent to which Co. 213 was infected but other varieties were still considered to be free. The following year Co. 213 developed the disease on a very severe scale, so badly in fact that satisfactory roguing became impossible, and a few cases were also found in Badilla and other varieties. In view of this it was decided to give up the planting of Co. 213 and none was planted after 1933—34. In 1934—35 there was, however, an increase in the extent to which Badilla became affected, and careful searches for the disease showed that many of the promising newer varieties were affected to some extent.

Control measures on the lines mentioned were immediately introduced.

The number of searches for diseased plants, as well as the interval between the searches, varied between different blocks according to the extent to which they were infected, but the average number of searches per acre throughout the entire area was just under ten, and during all the searches the total number of diseased plants removed averaged 371 per acre, giving an average of 39 per acre per search.

The average number of cases removed during the first search soon after germination was 75 per acre During the 16th search in a small area in which the original infection was heavy only 15 cases per acre were found compared to 100 for the first search in this particular area some five months earlier. In another block the first search revealed 441 cases per acre but the 12th search some six months later showed only 18.

These figures indicate the effectiveness of the control work, not only in keeping the disease from spreading, but in removing the existing infection from the fields.

At the beginning of the control work diseased plants could easily be noticed during a walk through the fields, but at the end of the first season's work they could only be found by careful searching, to a casual observer the fields appearing completely Smut free.

The total cost of the full Season's work on 400 acres was Rs. 1046-11-6, the cost per acre being Rs. 2—9—5, and the cost per search only Rs. 0-4-4 per acre.

The reduction in yield caused by severe infection cannot be accurately estimated, but even if it amounted to only 5% of a 30 ton crop the loss would be about Rs. 15 per acre, and it is likely that if uncontrolled the extent of the damage would rapidly increase in successive seasons.

Since 1934-35 'smut' control has been regularly carried out, the first searches for cases of the disease starting in about May and finishing towards the end of the year when the size of the crop and monsoon weather make it very difficult to continue.

In 1935-36 between 11 and 14 searches were made according to the extent to which different blocks were found to be infected. The highest number of cases found in any block during any one search was 5 per acre. The total number of cases found during the whole season was only 1099 in 150 acres, the average per acre being only 7. The cost of the work for the season was Rs. 1—12—8 per acre.

In 1936-37 the number of searches was between 6 and 13 and the total number of cases found was only 193 in 106 acres, the average per acre for the whole season being less than 2. The cost of the work that season was Rs. 0—13—0 per acre.

In 1937-38 the number of searches was five in all the cane and six in a small area. The total number of cases found during the season was only 55 in 112 acres, an average of less than one case in 2 acres. The cost of the control work for the season was Rs. 1—1—2 per acre.

In 1938-39 the work is being continued as a matter of routine and to the end of August 1938, 156 cases have been found in 108 acres the cost to date being just under 8 annas per acre.

These figures prove that by the adoption of simple control measures the disease can be effectively controlled. That the control measures and not natural causes are responsible for the reduction in infection is proved by the fact that while the disease has for all practical purposes been eliminated from the experimental farms of the E. I. D. & S. F. Ltd. it is still present in the ryots' cane.

It is not possible for all ryots' cane to be examined, but where the disease is noticed the E. I. D. & S. F. Ltd. will undertake at its own cost to initiate control measures. Work in ryots' cane was started in September 1937 and during the 1937-38 season an average of 137 cases per acre were removed from 326 acres in from one to three searches. As many as 325 cases were found in the first search in one plot of 1·20 acres. In 1938

-39, 60 cases per acre have been removed to date from 385 acres examined from one to four times.

V. Varietal Susceptibility. The main varieties grown in the Nellikuppam area are Badila, Co. 281 and POJ 2878. In 1934-35 the year in which 'Smut' was worst in the experimental farms of the E. I. D. & S. F. Ltd., Badilla represented 62% of the area grown by this Company but in 1937-38 the percentage fell to 4. In the same period the percentage of Co. 281 remained approximately the same, 19 and 20 respectively while the percentage of POJ 2878 increased from 7 to 37.

In 1934-35 Badilla was easily the worst infected the average number of diseased plants removed per acre for all inspections being 540. Co. 281 showed only 119 diseased plants per acre or 22% compared to Badilla. POJ 2878 was much less infected with only 16 cases per acre or 14% as compared to the Co. 281 and 3% compared to the Badilla. All other varieties together showed 73 per acre.

In 1937-38 the average number of cases removed from the small area of Badilla grown by the E. I. D. & S. F. Ltd. was 5 per acre, Co. 281 showed an average of 1 per acre, while no case at all was found in POJ 2878.

In the same year the average number of cases removed in all searches from ryots cane was 152 per acre from Badilla, 51 from Co. 281 and 14 from POJ 2878.

VI. Insect associated with Smut. Early in May 1934 a small black beetle was observed to be present in fairly large numbers on smutted plants, and it was thought that this might be in some way associated with the spread of the disease. Specimens were sent to the Government Entomologist, who reported them to be Endomychids which are usually feeders on lichens and fungi and as such are beneficial. It appears possible however that they may carry the disease spores on their body and so assist in spreading the infection.

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3. Sundararaman, S. & Krishnaswamy, C. S. Fungoid diseases of important crops in the Madras Presidency.
4. International Sugar Journal, 1934

EXTRACTS

Our Adventure in Conservation. East Side New York boys found themselves one morning in the high meadows of the Glacier National Park; New Jersey and Connecticut youths waded through late spring snows in the Mount Hood National Forest in Oregon; Texas farm boys saw their first mountains in Wyoming. Here was real adventure. City boys learned to drive trucks and tractors, to fell big trees, to build suspension bridges, to fight forest fires; learned how to take care of themselves in the wilderness. Here was hardihood. Shy boys, homesick for their mothers' apron strings, had "childishness knocked out of them". This, back in April, 1933, was the beginning of the Civilian Conservation Corps.

The idea of thus using the youth of our country must be credited to Professor William James, who in 1910 wrote an essay on the "Moral Equivalents of War," in which he stated that it was but a question of time until the nation's youth would be organized for a few of their young years as a part of an army enrolled against nature, rather than against a warring foe.

He believed that thus during peace we would preserve equivalents for the martial ideals and virtues of unity, surrender of private interest, loyalty, discipline and hardihood. This is what we have today in the CCC.

Each 200-man camp is under Army reserve officer, but the discipline is not military. It is secured through the personality of the reserve officers, and by a few simple penalties maintained primarily by the boys themselves A "goldbricker" entering a camp soon finds that loafing on the job is not popular, and that he must do his share; if he "can't take it," he leaves. For minor infractions, there is a denial of week end leave, for more serious ones a fine not exceeding three dollars, for very serious ones discharge from the Corps.

In each camp, besides the reserve officer in charge there is a junior and a medical officer. From the boys themselves are drawn cooks, orderlies, a mess steward, a supply steward, hospital aid, assistant educational adviser, clerks and truck drivers. All jobs outside of camp are directly under experts from the Agriculture and Interior Departments—engineers, foresters, biologists, agronomists, soil specialists, landscape architects, entomologists. In addition to directing the work, these men train the boys not only in the use of tools and machinery but also in the *how* and *why* of their work. As a result, thousands of the young men become so proficient that after a year or so they are offered better jobs in the outside world. The quantity and quality of their work have surprised seasoned foremen used to handling older, more skilled workmen.

The outdoor exercise in forest or field has its inevitable effect on their bodies, their minds, and their spirits, and one soon notices the growing and hardening muscles and the cheerful faces. Pride and self-respect are restored.

There is no dearth of work for the CCC to do. We have thousands and thousands of square miles of horribly mutilated and barren forest lands with remnant ghost towns—today's witnesses to man's ruthlessness. We face the task of restoring trees to this land, now classified as "submarginal agricultural land." There are also the many flood-eroded areas. There are forest parks to be maintained and protected.

The boys of the Corps—some two million all told since 1933—have fought forest fires on a thousand fronts; they have checked and controlled blister rust in the Northwest, Dutch elm disease in the Northeast, pine twig blight in the Southwest, and grasshoppers in the Middle West. They have battled bark beetles in Western forests, gypsy moths in the East—forest insects and tree diseases on

over 15,000,000 acres. They have planted over a billion young trees after collecting the seed, making the forest nurseries, and growing the seedlings. They have built 90,000 miles of truck trails or forest roads primarily as protection against forest fires, they have completed over 3,500,000 soil-erosion check dams. And from their pay of $ 30 a month up to July 1, 1937, they have sent home over $ 400 000 000 to an estimated number of 6,000,000 dependents.

Whenever serious emergencies arose during the past four years, the call went out for CCC boys. Potomac, Ohio, and Mississippi floods, a Florida hurricane, an Alabama tornado, Oregon or Idaho forest fires, blizzards in Neveda, Utah or Wyoming, the Middle West drought of 1934, the advance of grasshopper and Mormon cricket hordes—always these called the CCC boys to rescue life and property. Not infrequently there were acts of real heroism, and outstanding ones are recognized by an Award of Valor, a special certificate for the Corps.

The CCC has been extended to mid—1940, its strength fixed at 315,000 men. The maximum term of enrollment is two years, except for a few special men. And, while preference is given to "relief rollers," the financial status of applicants will not be a bar to enrolment, provided the youth is in need of employment. Enrollees will still be required to send home part of their pay, but provision is made for the paymasters to retain a part of a man's monthly compensation to give to him in a lump sum at the time of his discharge.

The social values of the CCC are just beginning to be realized. It is combating the three main causes of juvenile crime and delinquency—faulty physical environment, faulty family contacts and faulty personality adjustment to society. Statements from the superintendents of the Nebraska Reformatory for Men and of the Virginia State Penitentiary credit the CCC with a drop in the number of inmates, in the former case a 25 percent decrease since 1933.

The saving of the remnants of our natural resources from abuse and of our youth from the effects of depression has just begun. The work of destruction on the former, running back through generations, cannot be repaired in a brief four years; denudation was too thorough and lasted too long. There are millions of boys entering the youth class of 17 to 23 each year who will need healthy, outdoor work, who will need to learn something of social discipline, who will need to learn the lessons of practical conservation. No one can say that this big job of national conservation is now finished; it will take generations to complete.

Reader's Digest. January 1938.

Nitrogen and Phosphorus in Oranges. The Nitrogen and Phosphorus content and the Nitrogen/Phosphorus ratio of orange juice and their relation to size of crop. Anderssen, F. G. and Bathurst, A. C. *Farming in S. Africa*, XIII, 349 (1938).

This work is the latest of the series of investigations by the senior author on citrus fertilization. With the aid of suitable curves, the authors have attempted to correlate the total nitrogen content as well as the nitrogen/phosphorus ratio in the orange juice with the yield of the crop and the theory that "in the case of Navel oranges at any rate, highest yields of fruit are accompanied by an optimum content of these substances in the juice." Results from previous experiments suggest that yields can be increased by increasing the dosage of nitrogen applied to the trees till the nitrogen content of the juice reaches a certain point, above which yields drop; further high nitrogen content of the juice was associated with low phosphorus concentration and vice versa.

A suggested explanation for this decrease in size of the crop associated with high nitrogen content in the juice is that the in-take or utilization of phosphorus is depressed by high nitrogen absorption. In other words nitrogen appears to be the limiting factor only up to a certain point from which turning point phosphorus becomes the limiting factor.

The ratio of nitrogen to phosphorus in the juice (referred to as the N/P ratio) is single convenient figure indicating whether nitrogen or phosphorus is the limiting factor to yield. Curves from experiments conducted for three consecutive seasons are compared and it is found that the optimum N/P ratio of the juice associated with maximum yields varied from about 8·7 to 9·9 which can be regarded as falling within quite a narrow range when compared to the ratios for all the different plots which varied from about 3·5 to over 12. Apart from the ratio itself, however, the writers emphasize the importance of absolute quantities of nitrogen and phosphorus in the juice and conclude that it is really a combination of these values, viz., N/P ratio, absolute nitrogen content and absolute phosphorus content that will have to serve as a criterion in determining the nitrogen and phosphorus requirements of orange trees.

On a statistical analysis of the date relating to the nitrogen and phosphorus contents in the juice of various samples of fruits and the yields of trees concerned, it was found that a significant relationship existed between the N/P ratio of any sample of juice and the yield of the respective trees. These results are taken to be further evidence for the theory correlating highest yield with the optimum concentration of nitrogen and phosphorus in the juice. Further fertilizer experiments are being laid down to confirm the conclusions here reported that an analysis of the fruit juice (i. e. the nitrogen and phosphorus contents) will give an idea of the fertilizer requirements (i. e., nitrogen and phosphorus) of a particular orchard. *V. T. Balakrishna Menon.*

A New Chapter in Soil Fertility. Developments of the first importance in agriculture may follow from research work approaching completion in the laboratories of the Botany Department, Queen Mary College, London. Scientists have long been aware of the fact that Indian rice crops, despite the absence of any system of manuring, continue year after year without loss of quality. It was thought possible that, during the flooding of the rice fields, the under-water plant life (*algae*) may have acted as a natural fertilising agent. Mr. P. K. De, sent to England by the Imperial Agricultural Research Council of India, has been working under the direction of Professor F. E. Fritsch, F. R. S. at Queen Mary College, where it has been conclusively proved that certain of the blue-green *algae* occuring in the water have the power to absorb nitrogen from the atmosphere, and thus after decay to enrich the soil and in turn to feed the rice crops. "As a result of this discovery," states Professor Fritsch, "it may be possible, with a little successful manuring, greatly to enhance the nitrogen-absorbing capacity of these algae and thus to improve the rice crop. Now we know for certain the hitherto mysterious source from which the rice crops draw their strength. It is possible that further research will open a new chapter in soil fertility."

This achievement follows a two-years' investigation and many disappointments. To prove without doubt that the *algae* itself was absorbing nitrogen, it was first necessary to secure specimens of blue-green algae completely free from bacteria. After ten months' work, six different specimens were secured entirely separate from any other growth, and it was then established beyond doubt that this low form of plant life does in fact take in nitrogen and is thus a natural manuring agent. The economic importance of this discovery lies in the fact that further research may show how this new knowledge can be extended to agricultural production, not only in India, but elsewhere. (*The Fertiliser, Feeding Stuffs and Farm Supplies Journal*) *Rhodesia Agricultural Journal*, Vol. 35, Page 756—57.

ABSTRACTS

Improvements in Agricultural Marketing in Madras Presidency, A meeting of the Provincial Marketing Board was held on the 31st October 1938 when among other subjects, the development work done so far by the Marketing Section in Madras came for review. During the first three years, the marketing staff were engaged in conducting marketing surveys of over twenty-five commodities comprising rice, groundnuts. tobacco, fruits, cattle, sheep and goats, eggs, milk, wheat, linseed, gram, barley, coconuts etc. As a result of these marketing surveys, development work in Agricultural marketing was recently started in order to bring home to the grower better margins for his produce.

As a first step in marketing improvement, a beginning was made by organising producers to pool their produce through Producers' Associations and putting them in direct touch with wholesale merchants without the intervention of middlemen. Side by side, arrangements were made to create facilities for grading the produce to enable producers to obtain better value for quality and have a better basis for price quatations. The first growers' society started at Koduru in Cuddapah district marketed this year Rs. 36,530 worth of the famous 'Sathgudi' oranges through the Provincial Marketing Society, Madras. Kodaikanal grapes to the value of Rs. 24 650 were sold to a number of makets by the Fruit Growers' Association started in Madura district. The Nilgiri Potato Growers' Association marketed produce worth over Rs. 20,000. In the course of the last 3 months, nearly 57,000 eggs of the value of about Rs. 1,000 were graded and marketed by an Association formed of the egg producers in Ongole taluk of Guntur district. Thus, including graded tobacco referred to below, produce worth about two lakhs of rupees in the aggregate was marketed directly by Producers' Associations in different parts of the Presidency. Work on such lines is increasing and is bound to increase, as obviously middlemen's charges are reduced and better returns realised by the producer in every case, At the same time, these societies are enabled to get the initial financing required for cultivation expenses and for holding on the produce for better prices. Similar Associations for the marketing of oranges in Chittoor district, limes in West Godavari district and mangoes in Vizagapatam district are being organised.

The work of grading of the produce is an important line of work in the scheme of improved marketing. The Agricultural Produce (Grading and Marking) Act of 1937 authorises *bona fide* agencies to trade in graded produce approved by the Marketing Section. Under the provisions of the Act, the Indian Tobacco Association, Guntur, has so far arranged for export of about 770 bales of Virginia tobacco worth about a lakh of rupees in recognised standard grades to England. It is hoped that this method would tend to create a steady demand for Indian tobacco in England and to maintain its reputation for quality to which no particular attention was paid previously. In consultation with the Government Food Analyst, arrangements are in progress to have a comprehensive scheme for standardising ghee in order to help the producers and the consumers alike and minimise malpractices. As already mentioned, a thousand rupees worth of eggs have been graded under definite grades, marked as such and sold in Madras in the course of the last 3 or 4 months. Arrangements are being made to have a comprehensive scheme of grade standards for rices at Bezwada, Nellore and Tanjore, for 'Sathgudi' oranges produced in Cuddapah district and mangoes in the Chittoor district; these are expected to start work in the coming season. All India standard contract forms as a basis for trade in groundnuts are under circulation among the interests concerned, and it is hoped they will be adopted soon. It will be thus seen that the general work of grading which is a main item in the

structure of better prices for the grower, is being organised on a large scale in this Presidency.

The provision of cheaper transport by rail for agricultural produce has made considerable progress in recent years, due to the efforts of the Marketing Section in co-operation with the Railway administrations in our Presidency. Reduced rates given for plantains in the Godavari area have borne fruit, and about 58,000 railway maunds of plantains of the value of about a lakh of rupees have moved during 1938 to Delhi and other big cities in North India at cheap parcel rates. Reduced rates for—milch cattle, to and from Madras, connecting places in the Guntur and Nellore districts, have been provided for facilitating movements of dry cows to pastures in the north and back again to Madras to counteract the usual practice of selling them to butchers on account of the heavy cost of either maintaining them in Madras or in transporting them to grazing areas in Nellore and Guntur districts. To provide for greater export trade in lime fruit as, number of reduced rates have been given from Palakol, Nidadavolu, Nuzvid, Bezwada, Tenali, Venkatagiri, Katpadi, Tiruvalam, Ayyampet, Dindigul, Kilakadayam etc. to all important consuming centres, and it is hoped that the grower and the trade will take full advantage of the facilities granted by the Railway administration concerned. Transport facilities for potatoes, pineapple, fish etc., are under consideration by the Railways concerned in order to increase the trade and secure a better supply to all consuming markets. The provision of insulated wagons for transport of fruits, fish etc., and also cold storage facilities for them are under consideration.

Work of marketing improvements is not complete until some form of control of selling agencies and markets is also created. Towards this end, regulated markets for tobacco in Guntur and groundnuts in the South Arcot districts are under consideration, where facilities for publication of prices, auction sales and correct weighments will be provided. These regulated markets will be gradually extended to other crops and markets as well. One such market is already functioning at Tirupur, Coimbatore district, for marketing cotton.

It is hoped that members of the general trade and producers will freely take advantage of the facilities offered and co-operate in such activities as the formation of Producers' Organisations, grading stations and regulated markets in various parts of the Presidency.

Agricultural Jottings

REPORT ON FAIRS AND MARKETS IN THE MADRAS PRESIDENCY

Shandy or the weekly market is a time honoured institution in India. These together with fairs associated with religious festivals were the chief agencies in the matter of assembly and distribution of agricultural produce, livestock and other commodities. At first their scope was limited to a few villages round about; but with the improved communications they came to serve a wider area and also deal with a greater variety of produce both raw and manufactured. The produce generally moves from the ryot to these fairs and shandies, whence to mundies in which wholesale business is transacted in towns, and from there finally to the big exporter situated at or near a port if it is an exportable commodity and vice versa if it is an imported one. With the improvement in communications and other facilities at the present day, some of the commodities may not pass strictly through these successive markets. On the other hand the produce may move from the ryots straight to mundies or even to the exporters at the ports though the former method holds good in the main.

There are in this Presidency 1,788 licensed markets. Of these the Local Boards maintain 1,117 public markets and have licensed 466 private ones while Municipalities maintain 205 public markets. These markets vary in number from district to district.

The markets may be annual fairs or weekly shandies as in rural parts and daily as in towns and cities. Those that are annually held are known as fairs. Naturally these are bigger than ordinary weekly markets and are usually associated with some festival connected with a temple. An important feature of these fairs is the assembly of livestock purely or in conjunction with agricultural products The period when these fairs are held is usually January to May when harvests are over and the agriculturist in general is having a slack season.

There are over 88 important fairs in this Presidency where livestock and agricultural produce are gathered. Attendance varies with the importance of the temple near which it is held, surrounding population and facilities for communication and so on and the attendance varies from 5,000 to 50,000. Some of the famous cattle fairs are at Karuvatti (Bellary district), Mahanandi (Kurnool), Tiruvannamalai (North Arcot), Vridhachalam (North Arcot), Kalugumalai (Tinnevelly), Sivalpuri (Tinnevelly), Kalgunda (South Kanara), Tiruppur (Coimbatore), and number of cattle brought to these fairs varies from 10,000 to 25,000. Other livestock such as goats and sheep are also brought. Among the weekly shandies, the biggest are Pollachi (Coimbatore), Theni (Madura), Nainamalai (Salem) and Tadepalligudem (West Godavari).

Location. Annual fairs are generally held near a temple where the festival is celebrated, while the weekly shandies are held on the roadside or topes invariably open unenclosed spaces. Temporary pandals are erected by owners. Though sellers of particular commodities group together, they arrange themselves in utter confusion. A few permanent stalls of zinc shed or country tiles are put up in big shandy places. Water supply and sanitary arrangements are being improved. Town and city markets are as a rule much better.

Control. All markets which are acquired or maintained out of local or Municipal funds are termed as public markets, and those owned by private people under licence from local bodies are known as private markets. In public markets, invariably the right of collecting tolls and rents for sheds and grounds, which should be done according to approved schedule, is auctioned annually. Local people, merchants or agents have no direct voice in the management of these markets except in the case of the regulated market for cotton at Tiruppur (Coimbatore district) constituted under the Commercial Crops Markets Act. In the case of private markets, 15 per cent of the collections goes to the local bodies as District Board, Municipality or Panchayat and the management is entirely in the hands of the owner but subject to sanitary and other regulations.

In the non-regulated markets everyone is at liberty to purchase or sell. There is no authority to licence operators, to control transactions or to report arrivals, sales, prices, etc.

Besides the periodical weekly or annual markets there are "Mundies" for transacting wholesale business in all towns generally. Their business also is not governed by any regulations except one market in Masulipatam run by a registered body with rules and regulations.

Checking of weights and measures is provided for in the Madras Local Boards Act 1920 (S. 337).

Revenue obtained by Local Boards and Municipalities from the markets merge into general funds and only a negligible amount is spent in improving the markets.

If a shandy or fair is held in a Municipality the provisions of Madras District Municipalities Act V of 1920 apply; whereas outside Municipalities the Madras Local Boards Act XIV of 1920 applies. But in all these shandies whether public or private offences under the Nuisance Act and the Indian Penal Code are watched by the Police; the Public Health Department through its local Sanitary staff attends to the sanitary measures; whereas the veterinary officers attend the cattle fairs and inspect animals with regard to epidemics. The provisions of the Cattle Diseases Act are enforced if necessary through the District Collector and fairs are withheld during epidemics.

Market days. In a taluk or a group of villages where a number of weekly markets exist, the market days are distributed throughout the week so that merchants can visit one market after another for buying and selling. In urban areas daily markets are the rule.

Hours of business In big shandies like those at Pollachi and Theni articles intended for the market begin to arrive from the previous evening. But in smaller shandies business starts at about noon and closes before sunset. But annual fairs are held on three or four consecutive days and sometimes for longer periods.

Attendance. Attendance varies from a couple of hundred to 25,000 to 30,000 people. During seasons of rain or busy cultivation or epidemics, the attendance falls. The shandy caters to the needs of a small group of villages within a small radius of 3 to 4 miles to about 60 to 70 miles in case of big ones.

Communications. Communication by road, rail or canal is essential for good business. But generally speaking these are defective in most of the market places. Railways serve important towns and the advent of motor traffic has replaced much of the slow bullock cart traffic provided there is a metalled road. But still large areas have no metalled road and the bullock cart is the main transporting agency which is seriously handicapped by want of roads particularly during inclement weather Canal transport is limited to deltaic tracts. The Buckingham Canal which is on the East Coast is not carrying sufficient traffic due to competition and other causes. At the beginning of the year 1937, there was a total length of 52,723 miles of all classes of road including 3,038 miles of trunk road. The length of railways is 4,500 miles whereas that of navigable canals is 1,491 miles.

Produce. Produce that comes into these markets is chiefly agricultural produce like food grains, oilseeds and condiments and other domestic requirements, so far as small ones are concerned. In bigger markets manufactured articles also like cloth, brass and copperware, hides and skins, cattle, goats and sheep, ropes, bamboos, timber and the like are also sold. Jewellery and gold coins are sold. The value of produce offered for sale ranges from a few thousands to 5 to 6 lakhs of rupees.

Charges. No octroi duties are levied on goods entering villages or towns. But when goods enter market grounds they have to pay tolls or entrance fees according to an approved schedule. They vary according to size and importance of the market and have no relation to value of article. Usually they vary from four to six annas per cartload, one to two annas per pack animal and three to six pies per headload. Cattle and sheep and goats for sale are charged half to one anna per animal. These are the entrance fees besides which ground rent is usually charged. If permanent stalls are occupied a higher rate is charged from three pies to one anna per square yard. Only in Pollachi shandy the stall rent is not collected. Tenants hold stalls free by hereditary right but of course entrance fees are charged as usual. The contractor employs special staff for the

collection of the tolls and usually collects a fee higher than the prescribed rate from illiterate villagers.

Method of business. Most of the fairs, weekly markets (*shandies*) are the main assembling and distributive markets. The produce is offered for sale by ryots direct or through local merchants who purchase the produce from ryots by advancing money during cultivation season. The business is mostly retail in nature in smaller markets, while the wholesale business is found in bigger and famous markets like Pollachi (Coimbatore district), Theni (Madura); Nainamalai (Salem district) and mundies in all towns. In wholesale business in these markets and in mundies in towns business is transacted through commission agents who charge about six pies per bag of commodities. It is usual for these agents to take commission from both the seller and purchaser. The mundy owners may either purchase outright from village merchants or deal on commission basis. The method of fixing prices is by private treaty. After an enormous amount of higgling the final price is arrived at. Prices are also communicated by finger code in several markets or big secret code words especially in sale of cattle. No commodity is sold or purchased on grades. In rare instances open auctions are held. For instance mangoes in Chittoor, plantains in Trichinopoly, cardamoms in Bodinaickanur (Madura district) and paddy and groundnuts in Masulipatam.

In addition to the weekly markets retail shops are also present. Their number varies according to the size of village or town. They generally sell all commodities necessary for the village such as food grains, oils, condiments, salt, cloths etc. Specialised bazaars i. e., shops selling special articles such as food grains, jaggery, cloths, hardware, are found in bigger towns and cities.

Weights and Measures. No common weights and measures are in use in the Presidency. Each district and sometimes taluk has its own sets of weights and measures. This confusingly large number of weights and measures is a serious handicap to organised trade. A maund in Vizagapatam district weighs 880 to 900 tolas; In Anantapur 1,008 tolas; In Coimbatore 1,000 tolas; in South Kanara 1,120 tolas. A seer in Ganjam district is 32 to 42 fluid ounces; in Kistna 44 fluid ounces; in Vizagapatam 32 to 36 fluid ounces; East Godavari 32 fluid ounces; West Godavari 41·7 fluid ounces; in Guntur 45 fluid ounces; in Nellore 40 fluid ounces; in Bellary 41·7 ounces and so on.

Variation in weights and measures works very much to the disadvantage of royt with a corresponding advantage to merchants. The merchant uses the bigger maund or seer for purchase from the ryot whereas he uses the smaller maund or seer for sale to consumers.

Standardisation of weights and measures is an urgent need. At present the Imperial maund of 82⅔ pounds is used in all Railways and its use in local weighments is to be advocated. The existing provisions in Indian Penal Code deal with falsification of weights and measures and make no attempt to define the true standard type. Metallic weights and measures are stamped at present by a special establishment under the Revenue Department in the district and a charge is made for the same. Existing agencies for the prosecution of offences connected with false weights and mersures are the Municipal and the Local Board authorities and the police. However, such prosecutions figure very occasionally in spite of the fact that falsification continues to a large degree.

Market charges. These are very varied and fantastic. These figure prominently in commission trade. Merchants acting as commission agents in consuming centres offer to sell commodities consigned to them. Bulk of the fruit trade is carried on under this category. The commission agent without taking the

least responsibility charges the consignee for cooly, cartage, weighments, godown rent, commission on sales, postage and money order expenses. But there are also various other items charged sometimes in one commodity or another, such as mahima, charity etc. Not only this, a count of 100 means the seller has to give 105 which is a generally accepted extra. In some cases, e. g. Vizianagram, for every 1,000 mangoes sold the producer has to give actually 1,300 to 1,400 mangoes. Besides this, the middleman's commission and deductions for samples have also to be paid. In no market are the brokers licensed except in Ettyapuram (Tinnevelly district). It is desirable that the necessary market charges are brought within reasonable limits and unnecessary ones removed.

Regulated Markets. There is at present only one regulated market in this Presidency. The Act which governs this viz, the Madras Commercial Crops Markets Act (Act XX of 1933) was passed in 1933. It is at present enforced in the case of cotton within the municipal limits of Tiruppur in Coimbatore district. The Act is applicable to Tobacco and Groundnut, but it has not been applied so far in any part of the Presidency.

The Act provides for proper administration and better regulation of buying and selling of these commercial crops. The Government have to declare by notification in the local Gazette of their intention to exercise control over purchase and sale of these crops in a notified area. No person shall in the notified area set up, establish or continue or allow to be continued any place for purchase, sale, storage, weighment or processing of the commercial crop except under a licence. All operators including commission agents and weighmen but excepting the producer are to be licensed. The Government establish a market committee consisting of representatives of the growers and merchants with a few nominated members being the representatives of the Local Government and Municipalities or Local Boards as the case may be. These are all nominated by the Government in the first year, thereafter representatives of growers and merchants are elected according to the due procedure. The committee is empowered to frame necessary by-laws, to enforce provisions of the Act such as provision for a common place of business with facilities for storage defining nature of allowances to be made, setting up a dispute sub-committee, to settle disputes between buyers and sellers, provision for the supply of market intelligence, inspection of weights and measures and so on. To meet the expenditure under all these items the committee is empowered to collect a levy on the commodity sent out of the market area.

Lines of improvements will be the standardisation of weights and measures and size of packages, the use of metallic stamped weights, the licensing of commission agents and middlemen, regulation of market charges and allowances and stricter application of such other enactments. A general extension of Commercial Crops Markets Act for all the important crops and in as many market centres as possible is very essential. Improvements in road and rail communications and provision of postal and telegraphic communication where they do not exist at present, installation of radio receiving sets for market intelligence and improvements in water supply and sanitary conveniences are also very desirable.

Association of Economic Biologists, Coimbatore.

At a meeting of the Association held on Wednesday, 30th November with Rao Bahadur T. S. Venkatraman, C. I. E., Imperial Sugarcane expert in the chair, the following papers were presented.

Further studies on the control of Laphygma exigua a pest of tobacco nurseries. By M. C. Cherian and M. S. Kylasam. In a previous paper the nature of the cultivation of the tobacco nursery and the incidence of the pest at Chirala, (Guntur) were given. A study of the parasites and predators indicated that they are not very helpful in the control of the above pest.

The present paper embodies the result of the investigations made in 1937 and 1938 with a view to devise ways and means of controlling the pest. Trap-cropping with *Eleusine* (ragi) sown on the edges of the beds indicated a distinct possibility of securing control of the pest by inducing a heavy oviposition of eggs by the parent moths on its tender leaves; the latter with the egg masses could be picked off by labour. Sprays of lead arsenate (1 : 32) plus soft soap on ragi edges would, if given immediately after the hand picking of egg masses, appear to effectively control the caterpillars arising out of residual egg masses and thus may replace the costly labour now employed by the company in the hand picking of caterpillars therefrom. It appears also possible to bring about considerable reduction of the pest by raising ragi strips every 5th day on the edges and removing them in toto every 6th day.

Some factors affecting the resistance of plants to Insect pests. By P. N. Krishna Ayyar. In any programme of insect control the question of plant resistance is of prime importance. The practical value of this phenomenon is increasingly recognised and sought to be utilised. An investigation into the control of the cotton stem weevil served to bring this problem to prominence. Resistance is admittedly a complex phenomenon and a variety of factors is often found to influence the results. Much of the work on this aspect is found to be centred round sap-feeding insects. The factors concerned may be conveniently grouped under three or four main categories. Some are in the main ecological resulting in a transitory evasion of an insect; others are due to some external protective agencies; still others are traced to internal causes due to the presence or absence of certain chemical substances; the last class is also internal and is based on the food factor of insects. The purpose of this paper is to invite attention to the importance of the last factor.

On December 12th a second meeting was held with Rao Bahadur G. N. Rangaswami Ayyangar, F. N. I., I. A. S., in the chair, when the following papers were read.

On Certain Abnormalities in Sugarcane. By N. L. Dutt and M. K. Krishnaswami. The authors have recorded a number of abnormalities in sugarcane. Formation of buds at internodes and branching of leaves were observed. Occurrence of multiple false 'short blades' on a stalk and a cane bearing two arrows due to a slight bifurcation of the stalk were met with. One cane bore arrows on side shoots also in addition to the normal one. Floral abnormalities like, multiple stigmas, anthers bearing stigmatic papillae, etc., etc., were also noticed.

The Present position of Sugarcane and Bamboo Hybrids. By T. S. Venkataraman. In the year 1930 the Coimbatore Sugarcane Station succeeded in raising intergeneric hybrids between sugarcane and sorghum. Two of these are now in commercial cultivation in the country to a limited extent. These hybrids were, however, found to be somewhat lacking in growth vigour, a marked feature associated with the other productions from Coimbatore that sometimes yield even 50 to 100 per cent. more than extant kinds. The station was therefore, anxiously on the look out for other parents that might be expected to introduce greater growth vigour in these and other hybrids.

A row of bamboo clumps forms an avenue on one of the borders of the station: these were planted there on account of the constant and varied uses of the bamboo in a sugarcane plantation. The marked growth vigour of the bamboo

was very alluring, but the great and obvious disparity between the two parents appeared a serious handicap. A day to day acquaintance of the growth phases of the bamboo, however, engendered a feeling that, in spite of the observed differences, there existed essential points of similarity between the two plants. An attempt at hybridization between the two made in the year 1931 was, however, frustrated by the wild elephants destroying overnight the sugarcane parents which had been placed under the flowering bamboos for pollination. The attempt was repeated in 1937, the actual cross pollination being done at the Coimbatore Station instead of in the forests as before. This resulted in a first batch of eighteen hybrids.

Fortunately some of these hybrids proved fertile and a thousand plants from unbagged F_1 arrows– in spite of the wide gap bridged—are now under study. These show a fair number of bamboo characters not found in the interspecific hybrids of Saccharum. Besides many morphological characters the influence of the bamboo is noticed both in the growth and developmental phases of the hybrids. As usual with hybrids having Saccharum as the mother parent the population shows great variations - one or more of the bamboo characters exhibiting themselves in different individuals. For economic results sugarcane breeding depends on variations obtained. The introduction of the bamboo has not only increased the range of variations, but has afforded types not found in previous interspecific hybrids of Saccharum.

On 15—12—38 an interesting lecture on "The Punjab colonisation scheme" was delivered by Sri. V. Ramanatha Ayyar, Cotton Specialist, under the presidency of Mr. R. C. Broadfoot, I. A. S., Principal, Agricultural College, Coimbatore.

Crop and Trade Reports.

Paddy—1938-39—Second forecast report. The average of the areas under paddy in the Madras Province during the five years ending 1936-37 has represented 14·5 per cent of the total area under paddy in India.

The area sown with paddy up to 25th November 1938 is estimated at 8,980,000 acres. When compared with the area of 8,595,000 acres estimated for the corresponding period of the previous year, it reveals an increase of 4·5 per cent.

The increase in area occurs in East Godavari, the Deccan, the Carnatic, the Central districts, Tinnevelly and the West Coast.

The first crop has been generally harvested throughout the Province. Normal yields have been reported from Guntur, the Deccan (Cuddapah excepted), the West Coast and the Nilgiris. The yield is expected to be below normal in the other districts. The crop has been damaged by the recent cyclone in the districts of East Godavari, West Godavari and Kistna; in the other districts it has suffered from drought owing to the failure of the North East monsoon rains. The yield is likely to be reduced further unless rains are received.

The seasonal factor for the Province as a whole works out to 90 per cent of the average as against 95 per cent in the corresponding period of the previous year.

The wholesale price of paddy, second sort, per imperial maund of 82⅔ lbs. as reported from important markets on 5th December 1938 was Rs. 3—0—0 in Virudhunagar, Rs. 2—12—0 in Madura, Rs. 2—10—0 in Guntur, Rs. 2—8—0 in Bezwada, Chittoor and Tinnevelly, Rs. 2—7—0 in Trichinopoly, Rs. 2—6—0 in Vizianagaram and Ellore, Rs. 2—5—0 in Cocanada and Rajahmundry, Rs. 2—4—0 in Hindupur, Rs. 2—2—0 in Vellore, Rs. 2—1—0 in Conjeeveram and Kumbakonam,

Rs. 2—2—0 in Cuddalore and Rs. 1—15—0 in Negapatam and Mangalore. When compared with the prices published in the last report, i. e , those which prevailed on 7th November 1938, the prices reveal a rise of 25 per cent in Conjeevaram 19 per cent in Virudhunagar, 17 per cent in Chittoor, 11 per cent in Guntur, 8 per cent in Cocanada, Bezwada and Tinnevelly, 7 per cent in Ellore, Hindupur and Mangalore, 6 per cent in Rajahmundry and 3 per cent in Vizianagaram, Trichinopoly and Madura, the prices remaining stationary in Cuddalore, Vellore, Kumbakonam and Negapatam.

Sugarcane—1938—Intermediate Condition Report. The condition of the sugarcane crop is satisfactory except in the districts of East Godavari, West Godavari Kistna and Guntur where the crop suffered to some extent on account of the recent cyclonic weather and in the districts of Cuddapah, Chittoor, North Arcot, Salem, Ramnad and Tinnevelly, where the growth of the crop has been affected by the failure of the North-East monsoon rains. The yield is expected to be normal outside these districts if there is no deterioration in seasonal conditions.

The wholesale price of jaggery per imperial maund of 82⅔ lbs. (equivalent to 3,200 tolas) as reported from important markets on 5th December 1938 was Rs. 9—14—0 in Adoni, Rs. 7—6—0 in Rajahmundry, Rs. 7—4—0 in Salem, Rs. 6-14-0 in Vizagapatam, Rs. 6—9—0 in Cocanada, Rs. 6—7—0 in Cuddalore, Vellore and Trichinopoly, Rs. 6—3—0 in Chittoor, Rs. 5—8—0 in Mangalore, Rs. 5—6—0 in Erode, Rs. 4—15—0 in Bellary and Rs. 4—13—0 in Vizianagaram. When compared with the prices published in the last report, i. e., those which prevailed on 8th November 1938, these prices reveal a rise of about 38 per cent. in Salem, 23 per cent. in Rajahmundry and 14 per cent in Cocanada and a fall of 28 per cent. in Chittoor, 20 per cent. in Vellore, 16 per cent. in Trichinopoly, 15 per cent. in Mangalore, and 8 per cent. in Vizianagaram the prices remaining stationary in Vizagapatam, Adoni, Bellary, Cuddalore and Erode.

(*Director of Industries, Madras*).

Cotton Raw in the Madras Presidency. The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1938 to 9th December 1938 amounted to 507,033 bales of 400 lb. lint as against an estimate of 505,200 bales of the total crop of 1937—38. The receipts in the corresponding period of the previous year were 502,008 bales. 4,29,611 bales mainly of pressed cotton were received at spinning mills and 97,999 bales were exported by sea while 69,868 bales were imported by sea mainly from Karachi and Bombay.

(*Director of Agriculture, Madras*).

College News and Notes.

Students' Corner. A lull in the activities of the club was noticed during the month, the students being engaged in preparing for the second terminal examination.

Cricket. Our college sustained a defeat at the hands of St. Joseph's College, Bangalore, whom they met in the semi-final round in the Inter-collegiate cricket tournament conducted by the Madras University. St. Joseph's scored 117 (Godfrey 45 and Azeeny 18, Hegde 4 for 26, Dinker Rao 4 for 50). The Agricultural College were all out for a small total of 71 runs (Menon 26, Godfrey 6 for 26 and Pyres 3 for 28). In their second innings, the St. Joseph's College hit up 277 runs (Shrott 72, Mathais 50 and Godfrey 35, Sreenivasan 3 for 55, Dinker Rao 4 for 73, Shetty 1 for 10 and Kamath 1 for 18). Our College replied with a poor total of 80 (Shetty 32).

The Madras Veterinary College who were on a sports tour to Coimbatore, played a cricket match with the Agricultural College. The Agricultural College,

entering first, scored 192 for 9 and declared. (C. Ramaswami 85, Babu 32 and Menon 28, Sanjeeva 5 for 67, Hegde 3 for 70 and Seetharama Rao 1 for 12). The visitors were all out for 57 (Sreenivasan 4 for 12, Dinker Rao 3 for 16 and Kothandaraman 3 for 11). Following on, the visitors made 38 for 2 wickets when stumps were drawn for the day.

Hockey. A hockey match was played against the Madras Veterinary College team. Our College won by one goal to nil, Kesava Reddy being the scorer.

Visitors. Mr. R. W. Littlewood, Livestock Development Officer, was at Coimbatore from the 15th to 18th instant. During his stay he inspected the Agricultural College Dairy herd.

A batch of Senior B. A. Class Chemistry Students of the American College, Madura, accompanied by their Assistant Lecturer Sri. P. S. Lakshminarayana, visited the Agricultural College and Research Institute on the 19th instant.

The Maharajah of Travancore Curzon Endowment Lecture. Rao Bahadur G. N. Rangaswamy Ayyangar, F. N. I., I. A. S., Millets Specialist and Geneticist delivered the lecture under the above endowment on 1st and 2nd instants, the subject of his talk being "Studies in Sorghum—the Great Millet". The lecture was profusely illustrated with lantern slides and plant specimens specially got ready for the occasion, and Mr. R. C. Broadfoot, I. A. S., Principal, Agricultural College was in the chair.

Dr. J. S. Patel. Dr. J. S. Patel, Oil Seeds Specialist, and Editor of the Madras Agricultural Journal has been appointed as Jute Specialist under the Indian Central Jute Committee, Calcutta. He left Coimbatore on 22nd November 1938. We wish him good luck in his new sphere of activity.

OBITUARY

It is with profound regret that we record the sad demise of Mr. Malcolm Edward Couchman, C. I. E., I. C. S., who was the first Director of Agriculture of our Province from 1906 to 1911. He joined the Indian Civil Service in 1893, and was posted to the Madras Presidency. He was appointed Member of the Board of Revenue in 1919, and retired in 1926.

Weather Review—NOVEMBER 1938.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	1·7	−2·3	42·2c	South	Negapatam	4·5	−13·2	40·7
	Calingapatam	1·5	−2·4	40 2		Aduthurai *	3·7	−7·1	26·5
	Vizagapatam	12·1	+8·3	50·9		Madura	4·5	−0·5	25 7
	Anakapalli*	8 2	+4·4	50·8		Pamban	2 2	−9·8	21·0
	Samalkota*					Koilpatti*			
	Maruteru*	8·6	+6·3	47·2		Palamkottah	6·2	−1·2	27·3
	Cocanada	10·0	+4·6	55·4					
	Masulipatam	0·4	−5·3	32·1					
	Guntur*				West Coast	Trivandrum	3·4	−3·2	54·4
						Cochin	5·9	−0·6	86·8
Ceded Dists.	Kurnool	Nil.	−1·1	23·5		Calicut	1·5	−3·9	132·8
	Nandyal*					Pattambi *	1·7	−2·2	87·8
	Hagari *	Nil.	−1·4	22·9		Taliparamba *			
	Siruguppa*	0·1	−1 5	28·6		Kasargode *	2·3	−1·6	140·4
	Bellary	Nil.	−2 2	23·4		Nileshwar*			
	Anantapur	0·1	−2·7	29·4		Mangalore	2·1	−1·0	143·8
	Rentachintala	0·2	...	28·7					
	Cuddapah	Nil.	−3·6	33 4					
	Anantharaju-pet *	0·6	−12 4	23·1	Mysore and Coorg	Chitaldrug	—	−2·3	21·2
						Bangalore	0·1	−2·8	31·5
Carnatic	Nellore	0·2	−11·0	29·7		Mysore	0·4	−2·1	19·0
	Madras	0·2	−14 0	24·1		Mercara	1·1	−2·1	134·4
	Palur *	3·1	−9·2	39·7					
	Tindivanam *	1·2	−9 9	27·9					
	Cuddalore	2·3	−12 8	30·2	Hills	Kodaikanal	2·8	−5·4	46·3
						Coonoor			
Central	Vellore	1·2	−5·7	31·6		Ootacamund *	1·0	−2·4	37·7
	Salem	Nil.	−3·7	28 9		Nanjanad *	1·1	−2·5	33·7
	Coimbatore	0 4	−3·4	11·5					
	Coimbatore A. C. & R. I.*	1·2	−3·6	12·6					
	Trichinopoly	0·6	−5·0	21·0					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 published in the Fort St. George Gazette.

c revised figure.

A depression in the Bay of Bengal between Ceylon and Tenasserim on the 4th intensified into a severe storm on the 9th and after causing fairly wide spread thunder showers over the south of the peninsula and South East Madras, gradually weakened and got filled up on the 13th. A second depression appeared in the East of the Bay on the 21st and after intensifying moved North West and crossed the North Madras Coast on the 25th instant. It occasioned heavy rains and some damage on the Circars Coast.

Thunder showers were general in Malabar and Konkan; local in Mysore, and Bombay-Deccan. Rainfall was in defect in all places excepting in the Circars where it was in excess.

Skies were moderately to heavily clouded in the North Madras Coast, South East Madras and Mysore; lightly to moderately clouded in the Madras Deccan and clear or lightly clouded elsewhere. Humidity was generally in defect in the Deccan, North Madras Coast and South East Madras. It was in excess in Malabar.

The maximum temperature was above normal in the Konkan and Madras Deccan ; and below normal in South East Madras, Mysore and Hyderabad. The minimum temperature was below normal in the Bombay Deccan, Mysore, Madras Deccan and North Madras Coast.

Chief amounts of rainfall.

Cuddalore.	2·2 on 1st.
Palamkottah.	3·1 on 3rd.
Madura.	3·2 on 13th.
Cochin.	3·2 on 19th.
Cocanada.	9·0″ on 26th.
Vizagapatam.	6·0″ on 26th and 5·1″ on 27th.

Weather Report for Research Institute Observatory.

Report No. 11/38.

Absolute Maximum in shade	...	92·2°
Absolute Minimum in shade	...	58·5°
Mean Maximum in shade	...	86 8°
Departure from normal	...	+2·3°
Mean Minimum in shade	...	66·2°
Departure from normal	...	−2·3°
Total rainfall	...	1·21″
Departure from normal	...	−3·6″
Heaviest fall in 24 hours	...	0 75 on 4th.
Total number of rainy days	...	2
Mean daily wind velocity	...	1·5
Mean humidity at 8 hours	...	72·4
Departure from normal	...	−8·2

Summary. The month under review was practically dry but for the slight effects of the North East Monsoon felt during the middle of the 1st week. The rainfall for the month was 1·21″ of which 0·75″ was recorded on the 4th. The rainfall was largely in defect. The mean maximum temperature was above normal and the mean minimum was below normal. Skies were moderately to heavily clouded and the humidity was in large defect. P. V. R. & F. L. D.

Departmental Notifications.

Transfers.

Name of officers	From	To
Sri M. C. Menon,	A. D., (on leave)	A. D., Tirupathur.
,, N. Krishna Pillai,	A. D., (on leave)	A. D., Pollachi.
,, P. Paramanandam,	A. D., (on leave)	A. D., Ongole.
,, K. Venkataswami,	A. D., (on leave)	A. D , Madanapalle.
,, T. Paramanandam,	A. D., Madanapalle	A. D., I Circle.
,, S. Venkatarama Ayyar,	A. D., Madanapalli,	Khadi and Swadeshi Exhibition at Madras.
,, P. N. Krishnaswami Rao,	Cotton Asst , Coimbatore,	Asst., Cotton Nadam Cotton Scheme, Perundurai.
,, R. Krishnamurthy,	Asst., Nadam Cotton Scheme, Perundurai,	Cotton Asst., A. R. S.
,, M. Subramania Chetty,	Offg. F. M., A. R. S., Nandyal.	Offg. Asst., in Cotton, A. R. S., Guntur.

,, M Ratnavelu,	Asst. A. D., Tiruchengode,	Asst. A. D., Bhavani.
,, S. F. Fernando,	Asst. A. D., Bhavani,	Asst. A. D., Harur.
,, A. P. Balakrishna Nair,	A. D., Harur,	A. D., Tiruchengode.
,, B. N. Padmanabha Ayyar,	Offg. F. M., Hagari,	A. D., Bellary.
Hussam Sahib,	A. D., Bellary,	A. D , Guntakal.
Sri. N. V. Kalyanasundaram,	Exhibition Van duty,	F. M., Kalahasti.
,, C. Annamalai,	F. M., Kalahasti,	F. M., F. R. S., Kodur.
,, P. V. Samu Ayyar,	Asst. A. D., Srivelliputhur,	Cuddalore Warehouse.
,, K. Kuppumuthu,	A. D., Cuddalore,	A. D., Srivilliputhur.
,, K. S. Krishnamurthy,	A. D., Cuddalore,	A. D., Trichinopoly.
,, S. Mahadeva Ayyar,	A. D., Trichinopoly,	F. R. S., Kodur.
,, R. Subbiah Pillai,	Offg. Asst. Millets, A. R. S., Koilpatti,	Asst. Millets Section, Coimbatore.

Leave.

Name of officers.	Period of leave.
Sri. S. P. Fernando, Asst. A. D., Bhavani.	L. a. p. for 2 months from 3—1—'39.
,, M. Narayanan, F. M., Nileshwar.	L. a. p. for 46 days from 3—1—'39.
,, P. Seshadri Sarma, Asst. Millets, Hagari.	L. a. p. for 1 month and 20 days from 12—12—'38.
,, S. Venkatarama Ayyar, Asst. A. D , Mannargudi.	L. a. p. for 12 days from 12—12—'38.
,, B. S. Narasimha Ayyar, Asst. Chemistry Section, Coimbatore.	L. a p. on m. c. for 23 days from 5—12—'38.
,, S. Bhima Raju, Asst. A. D., Tatpatri.	L. a. p. for 4 months from 3—1—'38.
,, R. Krishnamurthy, Asst. Nadam Cotton Scheme, Perundurai.	L a. p. for 23 days from 1—12—'38.
,, P. V. Subba Rao, Asst. A. D., Giddalore,	L. a. p. on m. c. for 1 month and 10 days from 5—10—'38.
,, N. Krishna Pillai, A. D., Trivandrum.	Extension of l. a. p. on m. c for 25 days from 28—11—'38.
,, P. A. Venkateswara Ayyar; Teaching Asst., Coimbatore.	L. a. p. for 14 days and extension of l. a. p. for 18 days from 22—11—'38.
,, T. V. Krishnaswami Rao, A. D., Sompeta.	L. a. p, for 1 month from 3—1—'39.
,, B. Madhava Rao, Asst. A. D., Anakapalle.	L. a. p. for 1 month from 13—11—'38,
,, E. K. Govindan Nambiar, F. M., Taliparamba.	L. a. p. for 28 days from 26—11—'38.
,, P. Uthaman, Asst. Paddy, A. R. S., Pattambi.	L. a. p. for 15 days from 1—12—'38.
,, C. Rajasekara Mudaliar. ,,	L. a. p. for 23 days from 1—12—'38.
,, C. Annamalai, F. M., Kalahasti.	L. a. p. for 1 month from 24—11—'38.
,, B. Suryanarayanamurthy, F. M., A. R. S., Guntur.	L. a. p. on m. c. for 30 days and half average pay for 25 days.
,, M. K. Padmanabhan, Asst. Paddy, A. R. S., Pattambi.	L.. a. p. on m. c. for 15 days from 29—11—'38.
,, M. Rama Reddy, A. D., Cuddapah.	Extension of l. a. p. for 40 days from 14—11—'38.
,, T. Krishna Reddy, A. D., Koilkuntla.	L. a. p. for 1 month from 23—11—'38.
,, A. M. Muthayya Nattar, A. D., Pollachi.	Extension of l. a. p. for 40 days from 27—11—'38.

Sri. P. Abraham, Cotton Asst., Coimbatore.	L. a. p. for 9 days from 3—1—'39.
„ T. Paramanandam, A. D., Madanapalle.	Extension of l. a. p. for 10 days from 25—11—'38.
„ K. Cheriah Jacob, Asst. Systematic Botany, Coimbatore.	L. a. p. for 1 month and 26 days from 3 -1—'39.
„ B. N, Padmanabha Ayyar, F. M., Hagari.	Extension of l, a. p. m, c. for 1 month from 20--12--'38.
„ S. Mayandi Pillai, Cotton Asst., A. R. S., Koilpatti.	L. a. p. for 4 months from 3—1—'39.
„ C. Bujangarao, Fruit Asst., A. R. S., Anakapalle.	Earned leave on full pay for 28 days from 9—1—'39.

UNIVERSITY OF MADRAS

B. Sc. Degree Examination in Agriculture, 1938.

FIRST EXAMINATION

AGRICULTURE

(Monday, 4th April. 7 A. M. to 10 A. M.)

Maximum : 60 marks.

Answer six *questions. Questions* 1 and 5 *are compulsory.*

*1. Explain the causes of the Indian monsoons. Give reasons why the North-East monsoon should give a heavier rainfall than the South-West monsoon in Coimbatore district. (12 marks.)

2. Of what use are weather charts and forecasts to farmers? Tabulate month-year the average rainfall for the Central Farm. (9 marks.)

3. Describe briefly the soils of the Noyal Valley and enumerate the crops normally grown in this area. (9 marks.)

4. Soil fertility deteriorates by soil erosion. Why? Give examples from the Central Farm. Describe some practical methods of controlling soil erosion. (9 marks.)

*5. Enumerate the benefits to be derived from deep ploughing and mention any instances you know where deep ploughing is not only unnecessary but detrimental to crop production. (12 marks.)

6. What are the essential differences between a clodcrusher and a land-roller? Explain the effect of each on the different classes of soil with which you are familiar. (9 marks.)

7. Organic matter is essential in a fertile soil. Why? Illustrate your answer with particular examples. Describe how you would effectively incorporate the following into garden land:—(*a*) 5 tons of farmyard manure per acre, (*b*) 1 ton of slaked lime, (*c*) a sunnhemp crop of 10,000 lb. per acre. (9 marks.)

8. Give an account of the underground soil conditions which give rise to the best wells, and the factors which influence the water capacity of such wells. (9 marks.)

BOTANY

Monday, 4th April. 2. P. M. to. 5 P. M.

Maximum : 60 Marks.

Answer three *questions in each section in* separate *answer-books.*

Question 3 in A *and Question 5* in B *are compulsory.*

Section A

1. Give with examples and sketches the various devices by which plants climb. (9 marks.)

2. Describe and sketch all the types of inflorescence. Give two examples of each. (9 marks.)

*3. Group the following plants under their natural orders:— (*a*) *Carthamus tinctorus*, (*b*) Cinchona, (*c*) Coffee, (*d*) Helianthus. Mention the distinguishing characters of those orders and draw typical floral diagrams. (12 marks.)

4. Draw and describe in detail the cellular anatomy of a typical leaf. (9 marks.)

Section B

*5. Give an account of the nitrogenous nutrition of the legumes. Why are legumes important in the rotation of crops. (12 marks.)

6. How is water lost from plants and what part is played by the stomata with reference to the loss of water? (9 marks.)

7. What are chromosomes? Describe the process by which the gametes come to possess *n* number of chromosomes. (9 marks.)

8. Write notes on :— (*a*) enzymes, (*b*) plasmolysis, (*c*) coenocyte, (*d*) cytoplasm, (*e*) leucoplasts, (*f*) raphides. (9 marks.)

CHEMISTRY

(Tuesday, 5th April. 7 A. M. to 10 A M.)

Maximum : 60 marks

Question 4 in A *and question* 5 in B *are compulsory.*

Answer 3 *questions in* each *section in* separate *answer books provided.*

Section A

1. Compare and contrast the reactions of the aldehydes and ketones. (9 marks.)

2. Write notes on the following, illustrating your answers by suitable examples :— (*a*) optical activity, (*b*) polymerization, (*c*) diazotization, (*d*) tautomerism. (9 marks.)

3. Write a short account of the general properties and constitution of the aliphatic amines. How are they classified and how may the different classes be distinguished from one another? (9 marks.)

*4. How is glycerol manufactured? Discuss its constitution and enumerate its uses. (12 marks.)

Section B

*5. Give the general methods of preparation of the amino derivatives of benzene. Compare their properties with those of the aliphatic analogues. (12 marks.)

6. Write short notes on the following :— (*a*) Sandmeyer's reaction (*b*) law of substitution in aromatic compounds, (*c*) Perkin's reaction. (9 marks.)

7. How would you prepare the following substances :— (*a*) resorcinol, (*b*) hippuric acid, (*c*) vanillin? (9 marks.)

8. Give one example for each of three of the following reagents as reducing agents in organic synthesis :— (*a*) ammonium sulphide, (*b*) stannous chloride, (*c*) ferrous sulphate, (*d*) aluminium amalgam, (*e*) sodium methylate. (9 marks)

ZOOLOGY

(Tuesday, 5th April. 2 P. M. to 5 P. M.)

Maximum : 60 marks

Answer six *questions. Questions* 1 and 4 *are compulsory.*

*1. Write an essay on either 'Protozoa in relation to man and animals' or 'Modes of reproduction in the animal kingdom'. (12 marks.)

2. 'The protozoan is unquestionably a cell, but it is more than that: it is a complete organism.' Examine the validity of this statement. (9 marks.)

3. Describe the organization of a colonial coelenterate and point out how each type of individual is structurally adapted to the function it performs. (9 marks.)

*4. Describe with the aid of diagrams the essential features in the comparative anatomy of a cockroach and a frog. (12 marks.)

5. How do you distinguish—an Infusorian from a Sporozoan, an Elasmobranch from a Teleostean, a fish from a tadpole, and a snake from an eel? (9 marks.)

6. What are the characteristics of Ungulates? Name some of the common ones and write a few lines on the economic importance of each. (9 marks.)

7. How has parasitism affected the structure and organization of the following forms:—Opalina, Taenia solium, and Sacculina? (9 marks.)

8. Write explanatory notes on—symbiosis, cercaria, flame-cell, cloaca, trochophore, and allantois. (9 marks.)

SECOND EXAMINATION

AGRICULTURE. PLANT HUSBANDRY. I

Monday, 4th April. 7 A. M. to 10 A. M.

Maximum : 100 Marks.

Answer six *questions. Questions* 1 and 7 *are compulsory.*

*1. Write a short note on the difference in making compost according to the local method and that of the Indore systems. How are these prepared and which is better and why? The cost of making the stuff by both methods may be noted. (18 marks.)

2. A ryot has set apart 3 acres of his garden land for growing tabacco. Describe all the operations that are necessary for raising a good crop ready for market. What yields of cured stuff per acre of different varieties of tobacco would you consider satisfactory? (16 marks.)

3. Write short notes on—(*a*) silage-making, (*b*) drainage of arable land, (*c*) green manuring and green leaf manuring, (*d*) loose box system. (16 marks.)

4. What climate and soil do you consider most suitable for growing mangoes, citrus, and melons? For how long do these fruits require watering or channel irrigation? What are the most suitable months for planting and why? (16 marks.)

5. Write a short note on the possibilities of increasing the fodder crops including grasses in this presidency. What grasses would you recommend for growing in dry waste lands? What is meant by 'meadows and pastures'? Write a short note on each. (16 marks.)

6. What are the various improvements that you can suggest in the cultivation of (*a*) ground-nuts, (*b*) sugarcane? What would the ryot gain per acre in each of the above if he follows your advice? (16 marks.)

*7. What are the ingredients in the following manures:—bonemeal, dried blood, tannery refuse, ground-nut cake, sulphate of potash, sulphate of ammonia, and fish guano? (16 marks.)

8. Describe the various causes for the alkalinity of soils, and the different methods that are suggested for reclaiming them. Work out the cost of reclaiming an acre by adopting different methods. (16 marks.)

AGRICULTURE. PLANT HUSBANDRY. II

Monday, 4th April. 2 P. M. to 5 P. M.

Maximum : 100 marks.

Answer six *questions. Questions* 2 *and* 5 *are compulsory.*

1. Compare and contrast the irrigation systems of South India with those of the Indo-Gangetic plain. (16 marks).

* 2. What are the various mechanical devices employed for lifting water? Compare their relative efficiency. (18 marks).

3. Lay out for cropping the land commanded by a well fitted with a 3 inch pump, and show the allotments for the various crops in the different seasons of the year, say in the district of Coimbatore, with a view to derive the maximum benefit from irrigation. (16 marks).

4. In what respects does wet-land farming in the Godavari and Kistna deltas differ from that of the Tamil districts? Give reasons. (16 marks).

* 5. What is the role which ground-nut plays in South Indian husbandry? Mention some of the lines of improvement that are in progress in relation to this crop. Give a brief account of the cultivation of this crop in the black soil areas of the Ceded districts and prepare an abstract of the cultivation expenses. (18 marks.)

6. Explain the rationale of the agricultural practices mentioned below:—(*a*) folding sheep on the land immediately after sowing paddy in the dry; (*b*) planting tobacco seedlings twice, first in a second nursery and then in the main field; (*c*) harrowing continuously for three days immediately after sowing Tella jonna and Bengal gram; (*d*) planting kar paddy closely and in bunches, and samba widely spaced with a smaller number of seedlings in each hole. (16 marks).

7. What area would you allot for seed sufficient for 100 acres of each of the following crops:—sugar-cane, cotton, potato, ground-nut, and paddy? What is the basis of your calculation? (16 marks)

8. Write short notes on—sweet and pithy-stalked sorghum; Xenia; cholanathu; trashing sugar-cane; clarification of sugar juice; spinning qualities of cotton; and tube wells. (16 marks).

AGRICULTURAL ENGINEERING

(Tuesday, 5th April. 7 A. M. to 10 A. M.)

Maximum: 60 marks

Answer six *questions. Questions* 4 and 7 *are compulsory.*

1. Note the differences in materials and the methods of manufacture of—(*a*) ordinary country bricks, (*b*) table-moulded bricks, (c) wire cut bricks; and indicate the situations in a building where the above materials may be profitably used. (9 marks.)

2. Show a method by which the point of intersection of two lines meeting in a lake can be fixed, and how the distance of the intersecting point from one of the lines on the bank can be ascertained. (9 marks.)

3. In a closed traverse executed with a compass, what field and office checks are there on the accuracy of (*a*) the bearings taken, (*b*) the distance measured? (9 marks)

*4. A well is excavated 45 feet deep, and when finished is to be 4 feet in diameter. The soils met with are as noted below; first, 5 feet of loose soil; second, 10 feet of gravelly soil; third, 10 feet of soft rock; and the balance of the depth hard rock. Stone revetting is to be built in soft soils only. The thickness of the revetment may be taken as $1\frac{3}{4}$ feet. Draw a cross section of the neck, and estimate the quantities of work to be done. A parapet wall 3 feet high has to be built above the ground level. (12 marks)

5. Sketch a simple type of sprayer, also a press for pressing cotton, and describe the construction of each. (9 marks.)

6. Describe the most useful items of farm machinery used on a large farm. What are the factors which make their use economical? (9 marks.)

*7. Set out the installation of a power driven jaggery making plant, and describe the essential features thereof. A special detailed sketch of the type of furnace recommended by you should be shown and its merits described. (12 marks.)

8 What is the most economical type of internal combustion engine for use on a farm for power production purposes? Describe the principle on which it works. (9 marks.)

AGRICULTURAL ZOOLOGY

(Tuesday, 5th April. 2 P. M. to 5 P. M.)

Maximum: 60 Marks.

Answer six *questions. Questions* 1 and 3 *are compulsory.*

*1. What are arachnids? Discuss their economic importance. (12 marks.)

2. State with the aid of diagrams how you would distinguish—(*a*) Mallophaga from Siphunculata, (*b*) Acridiidae from Tettigonidae *(Locustidae)*, *(c)* Coccinellidae from Curculionidae, *(d)* Syrphidae from Tachinidae, *(e)* Geometrid larva from Tenthredinid larva. (9 marks.

*3. Give a brief account of the more important insect pests of Mango and Citrus trees in South India under the following heads:—(*a*) name and family of the insect; (*b*) nature and extent of the damage done; (*c*) control measures you would suggest. (12 marks.)

4. Discuss the scope of apiculture as a cottage industry in the Madras Presidency. Prepare a few hints for amateur bee-keepers. (9 marks.)

5. Write a short essay on 'Fumigants and their use in insect control'. (9 marks.)

6. Describe the role of insects in the spread of disease. Give examples to illustrate your answer. (9 marks.)

7. Give a short account of the more important introduced insect pests found in South India. What is your opinion regarding the existing checks to prevent such pest introduction? (9 marks.)

8. Write short notes on—(*a*) super-parasitism, (*b*) lace-wings, (*c*) lac, (*d*) pyrethrum, (*e*) apterygota, (*f*) termites. (9 marks.)

ANIMAL HYGIENE

Wednesday, 6th April. 7 A. M. to 10 A. M.

Maximum: 60 marks.

Answer six *questions. Questions* 2 and 5 *are compulsory.*

1. What are the lungs and heart? How are they disposed in the body of a cow? Give their functions. How do these organs in the cow differ from those of the foetus? Give reasons. (9 marks).

* 2. Name **three** contagious diseases which occur sporadically in cattle and describe any **one** of them under the following heads:—(*a*) aetiology, (*b*) source and channels of infection, (*c*) chief symptoms, (*d*) preventive measures. (12 marks).

3. Explain the following terms and state when and for what purpose each is employed in the treatment of animals:— (*a*) enemeta, (*b*) poultice, (*c*) counter-irritants. (9 marks).

4. How would you differentiate 'hoven' from 'impaction of the rumen'? Write out a prescription for a case of hoven in a bullock and state how the drugs prescribed act in that case. (9 marks).

* 5. Give the causes and the treatment of the following:— (*a*) a hen laying shell-less eggs, (*b*) a cow throwing out the cud, (*c*) scaly legs, (*d*) maggoted wound. (12 marks).

6. What is the average period of gestation in cows, ewes, and sows? What are the signs of pregnancy in cows? What is the care you have to take of pregnant animals? (9 marks).

7. What is 'turn-sick'? How is it caused in sheep? State the measures to be adopted to prevent further occurence of the disease in sheep. (9 marks).

8. Draw a diagram of the skeleton of the right fore limb of a bullock. Name the several articulations in it and describe briefly any **one** of the long bones in the limb. (9 marks).

FINAL EXAMINATION

AGRICULTURE—ECONOMICS AND FARM MANAGEMENT

Monday, 11th April. 7 A. M. to 10 A. M.

Maximum: 100 marks.

Answer six *questions. Questions* 1 and 6 *are compulsory.*

* 1. What live stock, dead stock, and buildings would be required for a demonstration farm of 50 acres, consisting of 10 acres wet land, 10 acres garden land, and 30 acres dry land? Work out the cost of such equipment. Prepare a cropping scheme for three years and give the income and expenditure for these years. (18 marks).

2. Write explanatory notes on:—agricultural economics; value; and Raiffeisen system of credit. (16 marks).

3. What labour will be required to cut, cart, and stack fodder cholam from 15 acres of good garden land? (16 marks).

4. Thirty acres of agricultural land are to be planted with an orchard. The soil is deep loam. Mention the fruits you would grow, with spacing, &c., and work out the economics of starting an orchard in the Madras presidency. (16 marks.)

5. What is meant by—(*a*) randomization; (*b*) *AB BA* method; (*c*) replication? Discuss each method and state which you consider better, and why.

Grafting and budding: discuss different methods in each. (16 marks.)

*6. What is meant by non-credit co-operative societies? Are there such societies in this presidency? If so, mention a few. Discuss the usefulness of such societies and suggest how their number can be increased in this presidency.

7. While inspecting a farm, what points would you take into consideration before announcing that it is well farmed or otherwise? (16 marks.)

8. The Annamalai University has a scheme of settling its unemployed past students by allotting them free of rent 120 acres of University land, consisting of 90 acres wet land and 30 acres of garden land. The soil is clayey. Each student should have Rs. 300 to Rs. 360 net income per year. State the exact number of students that could be settled there and draw up a cropping scheme that could be followed. (16 marks.)

AGRICULTURE—ANIMAL HUSBANDRY

(Monday, 11th April. 2. P. M. to 5 P. M.

Maximum : 100 Marks.

Answer six *questions. Questions* 1 and 5 *are compulsory.*

*1. Name the important cattle-breeding tracts of South India and describe in detail the methods of breeding and rearing in these centres. (18 marks.)

2. What are your views about selection versus cross-breeding in relation to the improvement of cattle in this country? Describe some of the recent activities in this direction adopted by the Agricultural Department of Madras. (16 Marks.)

3. Draw a plan and elevation of a shed suitable for housing a dairy herd of thirty cows and explain how the design conforms in its details to the type of a modern cow byre. (16 marks.)

4. Describe, by means of a diagram, the structure of a cow's udder and explain how milk is secreted and stored therein between intervals of milking. (16 marks.)

*5. What are the principal items involved in the cost of production of milk? State how you would economize these charges without affecting either the quality or the quantity of milk. (18 marks.)

6. What are specific milk constituents? How are these relatively distributed in (*a*) human milk, (*b*) cow's milk, (*c*) buffalo's milk, (*d*) goat's milk? (16 marks.)

7. How would you judge a sample of good quality butter? Prepare a score card for the various points you should keep in view in judging butter, in order of their importance. (16 marks.)

8. Write short notes on (*a*) dual-purpose breed, (*b*) free martin, (*c*) beestings (*d*) back-crossing, (*e*) homogenization, (*f*) whey, (*g*) uneven distribution of calvings. (16 marks.)

AGRICULTURAL BOTANY. I.

Tuesday, 12th April. 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six *questions. Questions* 4 *and* 6 *are compulsory.*

1. Describe the morphological and structural adaptations seen in plants growing under aquatic and xerophytic conditions. Give examples. (16 marks.)

2. 'The centre of diversity gives a clue to the centre of origin.' Discuss this conclusion with reference to cultivated plants. (18 marks.)

3. Describe the morphological and physiological changes which take place in (*a*) lab-lab, and (*b*) castor seed during the process of germination. Describe tests or experiments which you would make in support of your statement. (16 marks.)

* 4. Record all the interesting points about the morphology, histology, and physiology of the rice plant. (18 marks.)

5. Give the common and botanical names of the vegetables, flowers, and fruits grown in the orchard area of the Central Farm. Group them under their families, and list the families in their order of affinity in the natural system of classification. (16 marks.)

* 6. Describe in detail the floral structure and the method of pollination in the following crop plants:— (*a*) cholam, (*b*) coconut, (*c*) mango. (18 marks.)

7. Describe botanically and give the full life history of two weeds introduced into the Presidency. Devise practical measures for their control based on your knowledge. (16 marks.)

8. Write all that you know on the horticultural practice of 'budding'. (16 marks.)

AGRICULTURAL BOTANY. II

(Tuesday, 12th April. 2 P. M. to 5 P. M.

Maximum : 100 Marks.

Answer six *questions. Questions* 3 and 6 *are compulsory.*

1. Write a short essay on the work of any **one** of the following:—Charles Darwin, W. Hofmeister, Gregor Mendel, Hugo de Vries, or W. Johannsen. (16 marks.)

2. Summarize briefly the evidence on which the chromosome theory of heredity is based. (16 marks.)

*3. In maize, a variety with a yellow endosperm was crossed with another which had white endosperm colour and a 15:1 F2 ratio was obtained. How would you account for the above result? Explain fully with a checker-board diagram. What steps would you take to prove that the assumptions made by you to explain the above ratio was correct? (18 marks.)

4. 'The relation between the wild and the cultivated forms in certain cases is, that the wild plant parted with factor after factor till there came into being the long series of derived forms.' Explain the above with reference to any particular case. (16 marks.)

5. Describe with sketches the structure and life history of any **two** of the following:— (*a*) Chara, (*b*) Funaria, (*c*) Selaginella, (*d*) Pteris. (16 marks,)

* 6. Describe in detail any **one** plant disease of economic importance which you have studied, giving the reproduction and life history of the parasite. (18 marks.)

7. Give an account of the cytology of ascus formation. (16 marks.)

8. Write notes on:— (*a*) lethal factor, (*b*) graft-hybrid, (*c*) apospory, and (*d*) heterosis. (16 marks)

AGRICULTURAL CHEMISTRY. I

Wednesday, 20th April. 7 A. M. to 10 A. M.

Maximum : 100 marks.

Answer six *questions. Questions* 4 and 8 *are compulsory.*

1. What do you understand by the term 'tilth'? Outline a method whereby it can be measured. (16 marks.)

2. Discuss the evidence for and against the statement 'green-manuring is not as good as green-leaf manuring'. (16 marks.)

3. Write short notes on—(*a*) laterite, (*b*) colour of soils, (c) basic superphosphate, (*d*) SiO_2/R_2O_3 ratio. (16 marks.)

*4. What happens when a soil is shaken with a solution of sodium cloride? Discuss the nature of the change. (18 marks.)

5. Comment on the following:—(*a*) cyanamide as a manure; (*b*) nitrogen requirements of the Godaveri Delta ; (*c*) composition of the underground water of Coimbatore taking the Central Agricultural Station to represent the area; (*d*) potassium in its role of inducing resistance in plants. (16 marks.)

6. Describe in detail the preparation of ammonium sulphate in commerce. Compare it with sodium nitrate as a nitrogenous fertilizer. (16 marks.)

7. Mention the more important changes taking place during the storage of farmyard manure. How and to what extent is a knowledge of these changes used in the loose-box and pit systems of storage ? (16 marks.)

*8. What is the chemical composition of the more important soil-forming minerals? To what class does the parent rock of our black cotton soils belong? Account for the difference, if any, between the soils of the various cotton-growing tracts of the presidency. (18 marks.)

AGRICULTURAL CHEMISTRY II

(Wednesday, 20th April. 2 P. M. to 5 P. M.

Maximum : 100 Marks.

Answer six *questions. Questions* 5 and 8 *are compulsory.*

1. Describe in detail the changes that take place during the malting of cholam, and discuss the commercial possibilities of the process. (16 marks.)

2. Write short notes on the following:—digestion coefficient, auximones, nutritive ratio, and vitamins. (16 marks.)

3. Give the proximate composition of milk. How would you find out whether a sample of milk has been adulterated or not? (16 marks.)

4. Explain clearly the difference between—(*a*) fats and waxes, (*b*) pentoses and pentosans (*c*) gums and resins, (*d*) fixed oils and essential oils. (16 marks.)

*5. Describe the transformations that ground nut-cake undergoes when it is fed to milch cows, with reference to the ultimate fate of the nitrogen contained in it. (18 marks.)

6. What are the chief defects of the natural pastures of the Malabar Coast? What steps would you suggest to remedy them ? (16 marks.)

7. Discuss the importance of minerals to live-stock. (16 marks.)

*8. What is an enzyme? How do enzymes occur in nature, and what are their chief properties? Give a short account of the part played by enzymes in the digestion of food. (18 marks.)